VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT
AUF DEM GEBIET DES PATENTWESENS

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PCT

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INTERNATIONALER RECHERCHENBERICHT

(Artikel 18 sowie Regeln 43 und 44 PCT)

Aktenzeichen des Anmelders oder Anwalts	**WEITERES VORGEHEN**	siehe Mitteilung über die Übermittlung des internationalen Recherchenberichts (Formblatt PCT/ISA/220) sowie, soweit zutreffend, nachstehender Punkt 5
P 19509/Gf/av		
Internationales Aktenzeichen	Internationales Anmeldedatum *(Tag/Monat/Jahr)*	(Frühestes) Prioritätsdatum *(Tag/Monat/Jahr)*
PCT/EP 99/01220	25/02/1999	25/02/1998
Anmelder		
ROHDE & SCHWARZ GMBH & CO. KG et al.		

Dieser internationale Recherchenbericht wurde von der Internationalen Recherchenbehörde erstellt und wird dem Anmelder gemäß Artikel 18 übermittelt. Eine Kopie wird dem Internationalen Büro übermittelt.

Dieser internationale Recherchenbericht umfaßt insgesamt 3 Blätter.

[X] Darüber hinaus liegt ihm jeweils eine Kopie der in diesem Bericht genannten Unterlagen zum Stand der Technik bei.

1. **Grundlage des Berichts**

   a. Hinsichtlich der **Sprache** ist die internationale Recherche auf der Grundlage der internationalen Anmeldung in der Sprache durchgeführt worden, in der sie eingereicht wurde, sofern unter diesem Punkt nichts anderes angegeben ist.

   [ ] Die internationale Recherche ist auf der Grundlage einer bei der Behörde eingereichten Übersetzung der internationalen Anmeldung (Regel 23.1 b)) durchgeführt worden.

   b. Hinsichtlich der in der internationalen Anmeldung offenbarten **Nucleotid- und/oder Aminosäuresequenz** ist die internationale Recherche auf der Grundlage des Sequenzprotokolls durchgeführt worden, das

   [ ] in der internationalen Anmeldung in Schriftlicher Form enthalten ist.

   [ ] zusammen mit der internationalen Anmeldung in computerlesbarer Form eingereicht worden ist.

   [ ] bei der Behörde nachträglich in schriftlicher Form eingereicht worden ist.

   [ ] bei der Behörde nachträglich in computerlesbarer Form eingereicht worden ist.

   [ ] Die Erklärung, daß das nachträglich eingereichte schriftliche Sequenzprotokoll nicht über den Offenbarungsgehalt der internationalen Anmeldung im Anmeldezeitpunkt hinausgeht, wurde vorgelegt.

   [ ] Die Erklärung, daß die in computerlesbarer Form erfaßten Informationen dem schriftlichen Sequenzprotokoll entsprechen, wurde vorgelegt.

2. [ ] **Bestimmte Ansprüche haben sich als nicht recherchierbar erwiesen** (siehe Feld I).

3. [ ] **Mangelnde Einheitlichkeit der Erfindung** (siehe Feld II).

4. Hinsichtlich der **Bezeichnung der Erfindung**

   [X] wird der vom Anmelder eingereichte Wortlaut genehmigt.

   [ ] wurde der Wortlaut von der Behörde wie folgt festgesetzt:

5. Hinsichtlich der **Zusammenfassung**

   [X] wird der vom Anmelder eingereichte Wortlaut genehmigt.

   [ ] wurde der Wortlaut nach Regel 38.2b) in der in Feld III angegebenen Fassung von der Behörde festgesetzt. Der Anmelder kann der Behörde innerhalb eines Monats nach dem Datum der Absendung dieses internationalen Recherchenberichts eine Stellungnahme vorlegen.

6. Folgende Abbildung der **Zeichnungen** ist mit der Zusammenfassung zu veröffentlichen: Abb. Nr. 1

   [X] wie vom Anmelder vorgeschlagen

   [ ] keine der Abb.

   [ ] weil der Anmelder selbst keine Abbildung vorgeschlagen hat.

   [ ] weil diese Abbildung die Erfindung besser kennzeichnet.

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP 99/01220

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 6 H04L1/12

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 6 H04L

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	US 5 027 348 A (CURRY JR JAMES C) 25. Juni 1991 (1991-06-25) Zusammenfassung Spalte 1, Zeile 11 - Zeile 27	1-3
A	Spalte 2, Zeile 24 - Zeile 34	4,5

X	US 5 251 209 A (JURKEVICH MARK ET AL) 5. Oktober 1993 (1993-10-05) Spalte 3, Zeile 59 - Spalte 4, Zeile 32 Spalte 5, Zeile 14 - Zeile 23	1-3
A	Anspruch 1	4,5

X	EP 0 218 448 A (CANON KK) 15. April 1987 (1987-04-15) Zusammenfassung	1,2

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[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

[X] Siehe Anhang Patentfamilie

° Besondere Kategorien von angegebenen Veröffentlichungen :
"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist
"E" älteres Dokument, das jedoch erst am oder nach dem internationalen Anmeldedatum veröffentlicht worden ist
"L" Veröffentlichung, die geeignet ist, einen Prioritätsanspruch zweifelhaft erscheinen zu lassen, oder durch die das Veröffentlichungsdatum einer anderen im Recherchenbericht genannten Veröffentlichung belegt werden soll oder die aus einem anderen besonderen Grund angegeben ist (wie ausgeführt)
"O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht
"P" Veröffentlichung, die vor dem internationalen Anmeldedatum, aber nach dem beanspruchten Prioritätsdatum veröffentlicht worden ist
"T" Spätere Veröffentlichung, die nach dem internationalen Anmeldedatum oder dem Prioritätsdatum veröffentlicht worden ist und mit der Anmeldung nicht kollidiert, sondern nur zum Verständnis des der Erfindung zugrundeliegenden Prinzips oder der ihr zugrundeliegenden Theorie angegeben ist
"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann allein aufgrund dieser Veröffentlichung nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden
"Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist
"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
7. Juli 1999	15/07/1999

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ghigliotti, L

1

Formblatt PCT/ISA/210 (Blatt 2) (Juli 1992)

C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	EP 0 730 356 A (QUALCOMM INC) 4. September 1996 (1996-09-04) Zusammenfassung Seite 2, Zeile 50 - Zeile 55 Anspruch 1 ---	1
E	EP 0 905 939 A (LUCENT TECHNOLOGIES INC) 31. März 1999 (1999-03-31) Anspruch 1 Zusammenfassung -----	1

1

INTERNATIONAL SEARCH REPORT

mation on patent family members

ernational Application No
PCT/EP 99/01220

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5027348 A	25-06-1991	NONE	
US 5251209 A	05-10-1993	NONE	
EP 0218448 A	15-04-1987	JP 62269541 A	24-11-1987
		JP 63070662 A	30-03-1988
		JP 2023101 C	26-02-1996
		JP 7059036 B	21-06-1995
		JP 62076994 A	09-04-1987
		JP 62076995 A	09-04-1987
		DE 3687211 A	14-01-1993
		US 5086434 A	04-02-1992
EP 0730356 A	04-09-1996	AT 156954 T	15-08-1997
		AU 3476793 A	03-08-1993
		AU 683597 B	13-11-1997
		AU 4791196 A	16-05-1996
		CA 2128327 A	22-07-1993
		CN 1081040 A	19-01-1994
		DE 69313098 D	18-09-1997
		DE 69313098 T	12-03-1998
		DK 621998 T	16-03-1998
		EP 0621998 A	02-11-1994
		ES 2108260 T	16-12-1997
		FI 943410 A	16-09-1994
		GR 3025048 T	30-01-1998
		HK 1000689 A	17-04-1998
		IL 104412 A	14-11-1996
		IL 118832 A	10-03-1998
		JP 7506469 T	13-07-1995
		NO 942670 A	16-09-1994
		PL 172909 B	31-12-1997
		WO 9314588 A	22-07-1993
		US 5511073 A	23-04-1996
		US 5504773 A	02-04-1996
		US 5568483 A	22-10-1996
		ZA 9300290 A	22-11-1993
EP 0905939 A	31-03-1999	NONE	

INTERNATIONAL SEARCH REPORT

[redacted] Application No
PCT/[redacted] 99/01220

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L1/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 027 348 A (CURRY JR JAMES C) 25 June 1991 (1991-06-25) abstract column 1, line 11 - line 27	1-3
A	column 2, line 24 - line 34	4,5

X	US 5 251 209 A (JURKEVICH MARK ET AL) 5 October 1993 (1993-10-05) column 3, line 59 - column 4, line 32 column 5, line 14 - line 23	1-3
A	claim 1	4,5

X	EP 0 218 448 A (CANON KK) 15 April 1987 (1987-04-15) abstract	1,2

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
7 July 1999	15/07/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ghigliotti, L

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

[redacted] Application No
PCT/[redacted]99/01220

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 730 356 A (QUALCOMM INC) 4 September 1996 (1996-09-04) abstract page 2, line 50 - line 55 claim 1	1
E	EP 0 905 939 A (LUCENT TECHNOLOGIES INC) 31 March 1999 (1999-03-31) claim 1 abstract	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/[redacted]99/01220

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5027348 A	25-06-1991	NONE	
US 5251209 A	05-10-1993	NONE	
EP 0218448 A	15-04-1987	JP 62269541 A	24-11-1987
		JP 63070662 A	30-03-1988
		JP 2023101 C	26-02-1996
		JP 7059036 B	21-06-1995
		JP 62076994 A	09-04-1987
		JP 62076995 A	09-04-1987
		DE 3687211 A	14-01-1993
		US 5086434 A	04-02-1992
EP 0730356 A	04-09-1996	AT 156954 T	15-08-1997
		AU 3476793 A	03-08-1993
		AU 683597 B	13-11-1997
		AU 4791196 A	16-05-1996
		CA 2128327 A	22-07-1993
		CN 1081040 A	19-01-1994
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		DK 621998 T	16-03-1998
		EP 0621998 A	02-11-1994
		ES 2108260 T	16-12-1997
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		IL 118832 A	10-03-1998
		JP 7506469 T	13-07-1995
		NO 942670 A	16-09-1994
		PL 172909 B	31-12-1997
		WO 9314588 A	22-07-1993
		US 5511073 A	23-04-1996
		US 5504773 A	02-04-1996
		US 5568483 A	22-10-1996
		ZA 9300290 A	22-11-1993
EP 0905939 A	31-03-1999	NONE	

09/622982

Translation

2

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P 19509/Gf/ay	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP99/01220	International filing date (*day/month/year*) 25 February 1999 (25.02.99)	Priority date (*day/month/year*) 25 February 1998 (25.02.98)
International Patent Classification (IPC) or national classification and IPC H04L 1/12		
Applicant ROHDE & SCHWARZ GMBH & CO. KG		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 05 August 1999 (05.08.99)	Date of completion of this report 18 May 2000 (18.05.2000)
Name and mailing address of the IPEA/EP Facsimile No.	Authorized officer Telephone No.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/EP99/01220

I. Basis of the report

1. This report has been drawn on the basis of (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

☐ the international application as originally filed.

☒ the description, pages 3, as originally filed,
pages _____, filed with the demand,
pages 1,2, filed with the letter of 18 January 2000 (18.01.2000),
pages _____, filed with the letter of _____.

☒ the claims, Nos. _____, as originally filed,
Nos. _____, as amended under Article 19,
Nos. _____, filed with the demand,
Nos. 1-4, filed with the letter of 18 January 2000 (18.01.2000),
Nos. _____, filed with the letter of _____.

☒ the drawings, sheets/fig 1/1, as originally filed,
sheets/fig _____, filed with the demand,
sheets/fig _____, filed with the letter of _____.
sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

☐ the description, pages _____
☒ the claims, Nos. 5
☐ the drawings, sheets/fig _____

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-4	YES
	Claims		NO
Inventive step (IS)	Claims	1-4	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-4	YES
	Claims		NO

2. Citations and explanations

1. The following documents are cited in this report:

D1: US-A-5 513 213 (PATEL ET AL.) 30 April 1996

D2: EP-A-0 730 356 (QUALCOMM INC.) 4 September 1996

Document D1 has not been cited in the international search report.

2. Claim 1, insofar as it is clear (see observations in Box VIII), relates to a process for transmitting data via a bidirectional radio channel. In that process, digital data to be transmitted according to a first data transmission protocol is divided into individual data packets.

2.1. Document D2 is the closest prior art. In that document, data to be transmitted is also in the form of data packets of variable length. The data packets of variable length are converted into data frames of a fixed length for the purpose of transmission via the radio channel.

The application addresses the problem of adapting

the transmission of data packets to be transmitted to the requirements of the data to be transmitted.

The problem is solved in that the length of the data packets, which are transmitted via the radio channel in a data transmission protocol once the data to be transmitted has been converted, is dependent on a data packet identifier that is produced from the data packets to be transmitted.

2.2. Neither document D1 nor document D2 per se disclose the solution according to Claim 1. The solution also has not been suggested by either of those documents either alone or in combination. Therefore, the subject matter of Claim 1 is considered to be novel (PCT Article 33(2)) and to involve an inventive step (PCT Article 33(3)).

2.3. Claims 2 to 4 relate to developments to the process according to Claim 1. Consequently, the subject matter of Claims 2 to 4 is also considered to be novel (PCT Article 33(2)) and to involve an inventive step (PCT Article 33(3)).

3. There are no doubts as regards the industrial applicability of the subject matter of the application.

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Pursuant to the requirements of PCT Rule 5.1(a)(ii), document D2 should also have been cited in the description and the relevant prior art contained therein should have been briefly outlined (see also PCT International Preliminary Examination Guidelines, Ch. II, 4.4).

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. Claim 1 is not clear (PCT Article 6) since the wording is equivocal (compare "for an optimal use" with the statement of the problem on page 2, lines 4 to 7). Such equivocal wording is only admissible if the nature of the invention cannot be described in another manner. However, in the present instance a teaching that solves the problem could certainly be indicated (see also PCT International Preliminary Examination Guidelines, Ch. III, 4.7).

2. Claim 1 is not clear (PCT Article 6) since the expression "optimal use" in that claim is imprecise and vague. In particular, the technical criteria and technical manner used to achieve an optimal use are not obvious (see also PCT International Preliminary Examination Guidelines, Ch. III, 4.5).

3. Claim 1 is not clear since the expression "transmitting/receiving stations" (line 6 in Claim 1) has not been defined. The use of the definite article for an expression hitherto unused in the claim results in a lack of clarity of that claim (see also PCT International Preliminary Examination Guidelines, Ch. III, 4.1).

ANNEXES

TO THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

CLAIMS

1. Arrangement for optimizing data transmission over a bidirectional radio channel, where the digital data to be transmitted is divided into individual data packets according to a data transmission protocol at each of two transmitting and receiving stations,
characterized in that
at each transmitting and receiving station (A or B)
the number
and/or the length
and/or the priority
and/or the type (e.g., information, control characters, repeat blocks)
(data packet identifiers) of the data packets generated by the higher-level data transmission protocol (DÜPHE) and transmitted to the respective transmitter of the station is determined, and the data transmission protocol (DÜP) in at least one of the stations is selected as a function thereof in the sense of optimum utilization of radio channel capacity.

2. Arrangement according to Claim 1,
characterized in that
the length of data packets generated by the data transmission protocol (DÜP) is determined as a function of data packet identifiers.

3. Arrangement according to Claim 1 or 2,
characterized in that
data packets identifiers are determined at one station (e.g., A), and the data packet length at the same station (e.g., A) is determined as a function thereof in the sense of optimum utilization of radio channel capacity.

4. Arrangement according to Claim 1 or 2,
characterized in that

data packet identifiers determined at the one station (e.g., A) are transmitted to the remote station (e.g., B) where they are used to influence the length of the data packets of the data transmission protocol (DÜP).

5. Arrangement according to one of the preceding claims,
characterized in that
data packet identifiers determined at the two stations (A and B) are transmitted to the respective remote station, where they are used to set the length of the data packets of the data transmission protocol (DÜP).

Arrangement for Optimizing the Data Transmission over a Bidirectional Radio Channel

This invention relates to and is based on an arrangement according to the definition of the species of the main claim.

It is known that for transmission of digital data such as digitized speech or other digital information over a shortwave radio channel in both transmission directions (bidirectional), the digital data to be transmitted, which is alternately transmitted over the radio channel in the forward and reverse direction can be processed according to a predetermined data transmission protocol, also referred to below as DÜP, and divided into individual data packets (e.g., according to A. S. Tanenbaum, *Computer Networks*, Prentice Hall, Englewood Cliffs, 1981, pages 136 ff.). This digital data to be transmitted can also be processed first at a higher level according to another data transmission protocol, a higher-level data transmission protocol, also referred to below as DÜPHE, e.g., according to the known TCP/IP method (transmission control protocol/Internet protocol). For optimizing data transmission over such a bidirectional radio channel, there have already been proposals to determine the bit error rate at the receiving end and transmit it back to the transmitter, where the length of the data packets is revised accordingly (older German Patent Application 196 51 593.9).

Depending on the type of digital data to be transmitted and the higher-level data transmission protocol (DÜPHE) processing the data, such as TCP/IP, the resulting data packets and acknowledgments in both transmission directions may vary greatly in length and frequency, and thus data throughput can be greatly impaired even when using the above-mentioned optimization of data transmission with the data transmission protocol DÜP.

Therefore, the object of this invention is to create an arrangement for optimizing data transmission over a bidirectional radio channel, where the available bidirectional channel

capacity is optimally adapted to the data occurrence in both directions.

Starting with an arrangement according to the definition of the species of the main claim, this object is achieved by the characterizing features of the main claim. Advantageous refinements are derived from the subordinate claims.

According to this invention, before transmitting the data packets of the data transmission protocol DÜP, the data packet identifiers of the higher-level data transmission protocol DÜPHE according to the main claim are determined, i.e., the number and/or length and/or priority and/or type of data packets is determined, and the length of the data packets of the data transmission protocol DÜP is adjusted as a function thereof. A wide variety of possible combinations are conceivable for these data packet identifiers. In the simplest case, it may be sufficient to determine only the instantaneous number of data packets or the number of data packets to be expected. The adaptation is better if the instantaneous or expected length of the data packets of the data to be transmitted is also taken into account as an identifier. It is even better to determine the instantaneous or expected priority of the incoming data packets from the higher-level data transmission protocol DÜPHE to the data transmission protocol DÜP or to determine the instantaneous or expected type of data (information, acknowledgment, control commands or the like). Another identifier may be the respective relevance of the data packets of the higher-level data transmission protocol DÜPHE, e.g., the information that this is a repeat packet. This quantitative determination of data packet identifiers takes place on both sides of the wireless link, and then the parameters of the data transmission protocol DÜP can be adapted on the basis of these identifiers in the sense of optimum utilization of the radio channel. It has proven especially advantageous to influence the length of the data packets accordingly and thus also the frequency in switching between the two directions of the radio channel.

This invention is explained in greater detail below on the basis of a schematic diagram illustrating one embodiment.

VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS

PCT

INTERNATIONALER VORLÄUFIGER PRÜFUNGSBERICHT

(Artikel 36 und Regel 70 PCT)

Aktenzeichen des Anmelders oder Anwalts	**WEITERES VORGEHEN**	siehe Mitteilung über die Übersendung des internationalen vorläufigen Prüfungsbericht (Formblatt PCT/IPEA/416)
P 19509/Gf/ay		
Internationales Aktenzeichen	Internationales Anmeldedatum *(Tag/Monat/Jahr)*	Prioritätsdatum *(Tag/Monat/Tag)*
PCT/EP99/01220	25/02/1999	25/02/1998

Internationale Patentklassification (IPK) oder nationale Klassifikation und IPK
H04L1/12

Anmelder
ROHDE & SCHWARZ GMBH & CO. KG et al.

1. Dieser internationale vorläufige Prüfungsbericht wurde von der mit der internationale vorläufigen Prüfung beauftragte Behörde erstellt und wird dem Anmelder gemäß Artikel 36 übermittelt.

2. Dieser BERICHT umfaßt insgesamt 6 Blätter einschließlich dieses Deckblatts.

   ☒ Außerdem liegen dem Bericht ANLAGEN bei; dabei handelt es sich um Blätter mit Beschreibungen, Ansprüchen und/oder Zeichnungen, die geändert wurden und diesem Bericht zugrunde liegen, und/oder Blätter mit vor dieser Behörde vorgenommenen Berichtigungen (siehe Regel 70.16 und Abschnitt 607 der Verwaltungsrichtlinien zum PCT).

   Diese Anlagen umfassen insgesamt 4 Blätter.

3. Dieser Bericht enthält Angaben zu folgenden Punkten:

   - I ☒ Grundlage des Berichts
   - II ☐ Priorität
   - III ☐ Keine Erstellung eines Gutachtens über Neuheit, erfinderische Tätigkeit und gewerbliche Anwendbarkeit
   - IV ☐ Mangelnde Einheitlichkeit der Erfindung
   - V ☒ Begründete Feststellung nach Artikel 35(2) hinsichtlich der Neuheit, der erfinderische Tätigkeit und der gewerbliche Anwendbarkeit; Unterlagen und Erklärungen zur Stützung dieser Feststellung
   - VI ☐ Bestimmte angeführte Unterlagen
   - VII ☒ Bestimmte Mängel der internationalen Anmeldung
   - VIII ☒ Bestimmte Bemerkungen zur internationalen Anmeldung

Datum der Einreichung des Antrags	Datum der Fertigstellung dieses Berichts
05/08/1999	18.05.2000

Name und Postanschrift der mit der internationalen vorläufigen Prüfung beauftragten Behörde:
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INTERNATIONALER VORLÄUFIGER PRÜFUNGSBERICHT

Internationales Aktenzeichen PCT/EP99/01220

I. Grundlage des Berichts

1. Dieser Bericht wurde erstellt auf der Grundlage (*Ersatzblätter, die dem Anmeldeamt auf eine Aufforderung nach Artikel 14 hin vorgelegt wurden, gelten im Rahmen dieses Berichts als "ursprünglich eingereicht" und sind ihm nicht beigefügt, weil sie keine Änderungen enthalten.*):

Beschreibung, Seiten:

3	ursprüngliche Fassung			
1,2	eingegangen am	18/01/2000	mit Schreiben vom	18/01/2000

Patentansprüche, Nr.:

1-4	eingegangen am	18/01/2000	mit Schreiben vom	18/01/2000

Zeichnungen, Blätter:

1/1	ursprüngliche Fassung

2. Aufgrund der Änderungen sind folgende Unterlagen fortgefallen:

☐ Beschreibung, Seiten:
☒ Ansprüche, Nr.: 5
☐ Zeichnungen, Blatt:

3. ☐ Dieser Bericht ist ohne Berücksichtigung (von einigen) der Änderungen erstellt worden, da diese aus den angegebenen Gründen nach Auffassung der Behörde über den Offenbarungsgehalt in der ursprünglich eingereichten Fassung hinausgehen (Regel 70.2(c)):

4. Etwaige zusätzliche Bemerkungen:

V. Begründete Feststellung nach Artikel 35(2) hinsichtlich der Neuheit, der erfinderischen Tätigkeit und der gewerblichen Anwendbarkeit; Unterlagen und Erklärungen zur Stützung dieser Feststellung

1. Feststellung

Neuheit (N)	Ja:	Ansprüche	1-4
	Nein:	Ansprüche	
Erfinderische Tätigkeit (ET)	Ja:	Ansprüche	1-4
	Nein:	Ansprüche	
Gewerbliche Anwendbarkeit (GA)	Ja:	Ansprüche	1-4
	Nein:	Ansprüche	

2. Unterlagen und Erklärungen

siehe Beiblatt

VII. Bestimmte Mängel der internationalen Anmeldung

Es wurde festgestellt, daß die internationale Anmeldung nach Form oder Inhalt folgende Mängel aufweist:

siehe Beiblatt

VIII. Bestimmte Bemerkungen zur internationalen Anmeldung

Zur Klarheit der Patentansprüche, der Beschreibung und der Zeichnungen oder zu der Frage, ob die Ansprüche in vollem Umfang durch die Beschreibung gestützt werden, ist folgendes zu bemerken:

siehe Beiblatt

Zu Punkt V

Begründete Feststellung nach Regel 66.2 (a) (ii) hinsichtlich der Neuheit, der erfinderischen Tätigkeit und der gewerblichen Anwendbarkeit; Unterlagen und Erklärungen zur Stützung dieser Feststellung

1 In diesem Bericht werden folgende Dokumente genannt:

D1: US-A-5 513 213 (PATEL ET AL) 30. April 1996

D2: EP-A-0 730 356 (QUALCOMM INC) 4. September 1996

Das Dokument D1 wurde nicht im internationalen Recherchenbericht angegeben.

2 Der Anspruch 1, soweit dieser klar ist (siehe dazu die Bemerkungen zu Punkt VIII unten), betrifft ein Verfahren zur Übertragung von Daten über einen bidirektionalen Funkkanal. Dabei sind die zu sendenden digitalen Daten nach einem ersten Datenübertragungsprotokoll in einzelne Datenpakete aufgeteilt.

2.1 Der nächstliegende Stand der Technik ergibt sich aus dem Dokument D2. Auch dort bestehen die zu sendenden Daten aus Datenpaketen variabler Länge. Zur Übertragung über die Funkstrecke werden die Datenpakete variabler Länge in Datenrahmen fester Länge umgesetzt.

Der Anmeldung liegt die Aufgabe zugrunde, die Übertragung von zu sendenden Datenpaketen an die Erfordernisse der zu sendenden Daten anzupassen.

Die Aufgabe wird gelöst, indem die Länge der Datenpakete, die nach Umsetzung der zu sendenden Daten in einem Datenübertragunsprotokoll über die Funkstrecke übertragen werden, abhängig gemacht wird von einer Datenpaketkennung, die sich aus den zu sendenden Datenpaketen ergibt.

2.2 Weder das Dokument D1 noch das Dokument D2 für sich betrachtet offenbaren die Lösung gemäß Anspruch 1. Die Lösung wird auch weder aus einem einzelnen dieser Dokumente noch aus deren Zusammenschau angeregt. Der Gegenstand des Anspruchs 1 wird daher für neu (Artikel 33 (2) PCT) und auf einer erfinderi-

schen Tätigkeit (Artikel 33 (3) PCT) beruhend erachtet.

2.3 Die Ansprüche 2 bis 4 betreffen Weiterbildungen des Verfahrens nach Anspruch 1. Der Gegenstand der Ansprüche 2 bis 4 wird daher ebenfalls für neu (Artikel 33 (2) PCT) und auf einer erfinderischen Tätigkeit (Artikel 33 (3) PCT) beruhend erachtet.

3 Die gewerbliche Anwendbarkeit des Gegenstand der Anmeldung steht außer Zweifel.

Zu Punkt VII
Bestimmte Mängel der internationalen Anmeldung

Um die Erfordernisse der Regel 5.1 (a) (ii) PCT zu erfüllen, hätte in der Beschreibung noch das Dokument D2 genannt werden sollen; der darin enthaltene einschlägige Stand der Technik hätte kurz umrissen werden sollen (siehe auch PCT International Preliminary Examination Guidelines II-4.4).

Zu Punkt VIII
Bestimmte Bemerkungen zur internationalen Anmeldung

1 Der Anspruch 1 ist nicht klar im Sinne von Artikel 6 PCT, weil er aufgabenhaft formuliert ist (vergleiche die Formulierung "im Sinne einer optimalen Nutzung" mit der Formulierung der Aufgabe, Seite 2, Zeilen 4 bis 7). Derartige aufgabenhafte Formulierungen sind nur zulässig, wenn keine andere Möglichkeit der Natur der Erfindung nach besteht. Im vorliegenden Fall ist die Angabe einer Lehre, die die Aufgabe löst, jedoch zweifelsfrei möglich (siehe auch PCT International Preliminary Examination Guidelines III-4.7).

2 Der Anspruch 1 ist nicht klar im Sinne von Artikel 6 PCT, weil der Ausdruck "optimale Nutzung" in dem Anspruch 1 unbestimmt und vage sind. Es ist insbesondere nicht ersichtlich, nach welchen technischen Kriterien und auf welche technische Weise eine optimale Nutzung erzielt werden soll (siehe auch PCT International Preliminary Examination Guidelines III-4.5).

3 Der Anspruch 1 ist nicht klar, weil der Begriff "Sende/Empfangs-Stationen" (Zeile 6 in Anspruch 1) nicht definiert ist. Der Gebrauch des bestimmten Artikels für einen noch nicht im Anspruch verwendeten Begriff führt zur Unklarheit des Anspruchs (siehe auch PCT International Preliminary Examination Guidelines III-4.1).

1509-P

Verfahren zum Optimieren der Datenübertragung über einen bidirektionalen Funkkanal

Die Erfindung betrifft und geht aus von einem Verfahren laut Oberbegriff des Hauptanspruches.

Zur Übertragung von digitalen Daten, wie digitalisierte Sprache oder andere digitale Informationen über einen in beiden Übertragungsrichtungen (bidirektionalen) Kurzwellen-Funkkanal ist es bekannt, die zu übertragenden digitalen Daten, die abwechselnd in Hin- und Rückrichtung (Simplex-Betrieb) über den Funkkanal übertragen werden, nach einem vorgegebenen Datenübertragungsprotokoll, im folgenden DÜP genannt, aufzubereiten und dabei in einzelne Datenpakete aufzuteilen (z.B. nach A.S. Tanenbaum, Computer Networks, Prentice-Hall, Englewood Cliffs, 1981, Seiten 136 ff; EP 0730 356). Dabei können diese zu übertragenden digitalen Daten auch schon vorher in einer höheren Ebene nach einem anderen Datenübertragungsprotokoll, im folgenden DÜPHE genannt, aufbereitet sein, beispielsweise nach dem bekannten TCP/IP (Transmission Control Protocol/Internet Protocol)-Protokoll. Zum Optimieren der Datenübertragung über einen solchen bidirektionalen Funkkanal wurde auch schon vorgeschlagen, die Bitfehlerrate empfangsseitig zu messen und an den Sender zurückzuübertragen und dort in Abhängigkeit davon u.a. die Länge der Datenpakete entsprechend zu ändern (ältere Patentanmeldung 196 51 593.9). Ferner ist es bekannt, bei einem im Duplex-Betrieb arbeitenden Datenübertragungssystem, das zwei getrennte Übertragungskanäle aufweist, in Abhängigkeit vom jeweiligen Datenaufkommen die Datenrate zu ändern, um so die Übertragung unempfindlicher gegen Störungen zu machen (US-Patent 5 513 213).

Je nach Art der zu übertragenden digitalen Daten und des diese aufbereitenden Datenübertragungsprotokolls der höheren Ebene, z.B. TCP/IP (DÜPHE), können die anfallenden Datenpakete und Quittungen in beiden Übertragungsrichtungen sehr unterschiedliche Länge und Häufigkeit aufweisen und es kann damit selbst bei Anwendung

der erwähnten Optimierung der Datenübertragung mit dem DÜP zu erheblichen Beeinträchtigungen des Datendurchsatzes kommen.

Es ist daher Aufgabe der Erfindung, ein Verfahren zum Optimieren der Datenübertragung über einen bidirektionalen Funkkanal zu schaffen, bei dem die zur Verfügung stehende bidirektionale Kanalkapazität jeweils an die in beiden Richtungen anfallenden Datenaufkommen optimal angepaßt ist.

Diese Aufgabe wird ausgehend von einem Verfahren laut Oberbegriff des Hauptanspruches durch dessen kennzeichnende Merkmale gelöst. Vorteilhafte Weiterbildungen ergeben sich aus den Unteransprüchen.

Gemäß der Erfindung werden vor der Aussendung der Datenpakete der DÜP die Datenpaketkennungen der DÜPHE, also die Anzahl und/oder Länge und/oder Priorität und/oder Art der Datenpakete ermittelt und in Abhängigkeit davon die Länge der Datenpakete der DÜP eingestellt. Dabei sind die verschiedenartigsten Kombinationsmöglichkeiten für diese Datenpaketkennungen denkbar. Im einfachsten Fall kann es ausreichen, nur die momentane bzw. zu erwartende Anzahl der Datenpakete zu ermitteln. Besser wird die Anpassung, wenn zusätzlich auch noch die momentane bzw. zu erwartende Länge der Datenpakete der zu übertragenden Daten als Kennung mit berücksichtigt wird. Noch besser ist es, auch noch die momentane bzw. zu erwartende Priorität der vom DÜPHE in das DÜP einlaufenden Datenpakete zu ermitteln bzw. die momentane bzw. zu erwartende Art (Information, Quittung, Steuerbefehle od.dgl.). Eine weitere Kennung kann die jeweilige Aktualität der Datenpakete der DÜPHE sein, beispielsweise die Information darüber, daß es sich um ein Wiederholungspaket handelt. Diese quantitative Erfassung der Datenpaketkennungen erfolgt auf beiden Seiten der Funkstrecke und aus diesen Kennungen kann dann die Länge der durch das Datenübertragungsprotokoll DÜP erzeugten Datenpakete im Sinne einer optimalen Nutzung der Funkkanalkapazität eingestellt werden und damit auch die Häufigkeit, mit der zwischen den beiden Richtungen des Funkkanals umgeschaltet wird.

ANSPRÜCHE

1. Verfahren zur Übertragung von Daten über einen bidirektionalen Funkkanal, bei dem die zu sendenden digitalen Daten, die nach einem ersten Datenübertragungsprotokoll (DÜPHE) in einzelne Datenpakete aufgeteilt sind, in den beiden Sende/Empfangs-Stationen des Funkkanals nach einem zweiten Datenübertragungsprotokoll (DÜP) in einzelne Datenpakete aufgeteilt werden, die abwechselnd in Hin- und Rückrichtung im Simplex-Verfahren über den Funkkanal übertragen werden,
dadurch gekennzeichnet,
daß in jeder Sende/Empfangs-Station (A bzw. B)
die Anzahl
und/oder die Länge
und/oder die Priorität
und/oder die Art der durch das erste Datenübertragungsprotokoll (DÜPHE) erzeugten und dem jeweiligen Sender der Station zugeführten Datenpakete als Datenpaketkennung bestimmt wird und in Abhängigkeit von diesen Datenpaketkennungen in mindestens einer der Sende/Empfangs-Stationen jeweils die Länge der durch das zweite Datenübertragungsprotokoll (DÜP) erzeugten Datenpakete im Sinne einer optimalen Nutzung der Funkkanalkapazität bestimmt wird.

2. Verfahren nach Anspruch 1,
dadurch gekennzeichnet,
daß in der einen Sende/Empfangs-Station (z.B. A) die Datenpaketkennungen bestimmt werden und in Abhängigkeit davon die Datenpaketlänge in der gleichen Station bestimmt wird.

3. Verfahren nach Anspruch 1,
dadurch gekennzeichnet,
daß die in der einen Sende/Empfangs-Station (z.B. A) bestimmten Datenpaketkennungen zur Gegenstation (z.B. B) übertragen werden und dort zur Beeinflussung der Datenpaketlänge des zweiten Datenübertragungsprotokolls (DÜP) benutzt werden.

4. Verfahren nach einem der vorhergehenden Ansprüche,

dadurch gekennzeichnet,

daß die in den beiden Sende/Empfangs-Stationen (A und B) bestimmten Datenpaketkennungen zur jeweiligen Gegenstation übertragen werden und dort zur Einstellung der Datenpaketlänge des zweiten Datenübertragungsprotokolls benutzt werden.

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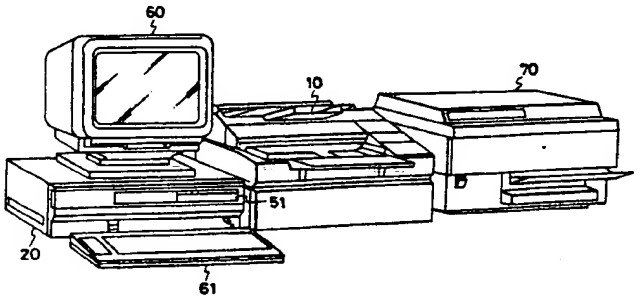
(54) Data communication process and apparatus therefor.

(57) There is disclosed a process for transmitting mixed data, composed of character code data and bit image data in blocks and an apparatus therefor. Efficient transmission can be achieved by selecting the size of blocks suitably according to the quantity of data in each block or the number of blocks.



EP 0 218 448 A2

TITLE OF THE INVENTION

Data Communication Process and Apparatus Therefor

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a process for data transmission and an apparatus therefor, and in particular to those for transmitting mixed data.

Related Background Art

For transmitting mixed data of different kinds, such as character code data and bit image data, there is already proposed a process of dividing a text into a plurality of character code blocks and bit image block, and transmitting the blocks in succession.

However, in case many characters, photographs and pictures are mixedly present, there will be involved a large number of blocks, which require a complicated protocol in transmission and a long time for reconstruction of the text upon reception, thus leading to a deteriorated efficiency of transmission.

SUMMARY OF THE INVENTION

In consideration of the foregoing, an object of the present invention is to provide a process for transmitting mixed data.

Another object of the present invention is to provide a process for transmitting mixed data with a high

transmission efficiency.

Still another object of the present invention is to provide an efficient process for transmitting a document containing areas where characters and non-character images are overlapped.

Still another object of the present invention is to provide a process of transmission allowing easy reproduction of the original document from mixed data.

Still another object of the present invention is to provide a data transmission process for transmitting a document by suitably dividing the same into blocks.

Still another object of the present invention is to provide a data transmission process for transmitting a document by dividing the same into a limited number of blocks.

Still another object of the present invention is to provide a data transmission system capable of transmitting, in mixed manner, data obtained by word processing and data obtained by image processing.

Still another object of the present invention is to provide a communication terminal apparatus enabling efficient processing of mixed data.

Still another object of the present invention is to provide a data transmission process capable of transmitting data obtained by character recognition.

The foregoing and still other objects of the present invention will become fully apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a communication terminal apparatus employing a transmission process of the present invention;

Fig. 2 is a perspective view of a communication apparatus embodying the present invention;

Figs. 3, 4A to 4C, 6, 7A to 7E and 9 are views showing data formats; and

Figs. 5, 8A, 8B and 10 are flow charts showing a transmitting process.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a block diagram of anembodiment of the present invention, and Fig. 2 is a perspective view of the embodiment.

A reader 10 is provided to generate an electrical signal by reading an original document.

A facsimile apparatus 20 is provided with a reader/printer interface 21; an image compression unit (ICU) 22; a program memory (PMEM) 23; a bit move unit (BMU) 24; an image memory (IMEM) 25; a video random access memory (VRAM); a central processing unit (CPU) 27; a communication interface 28; a bus 29; and a communication control unit (CCU) 30.

The image compression unit (ICU) 22 is provided for compressing or expanding data, and employs a two-dimensional compression (high compression) for

increasing the encoding rate.

The program memory (PMEM) 23 is provided with memory areas for an operation system program and an application program for controlling input/output devices and various units of the facsimile apparatus 20, for a font memory for converting character code data into image bit data, and for storing and editing text code data or character data obtained by key entry or word processing.

The program memory (PMEM) 23 is provided with a memory management unit (MMEU) and a work area functioning as a buffer for transmitting data from a rigid disk 50 through the communication control unit (CCU) 30 or receiving data from the unit 30 to the rigid disk 50 and for transmission speed matching between the rigid disk and the communication channel.

The bit move unit (BMU) 24 is provided for image processing such as enlargement, reduction, rotation, displacement or extraction of a predetermined image in bit unit on a cathode ray tube 60.

The image memory (IMEM) 25 has a capacity of 4 Mbytes for storing image data from the reader, edited image data obtained from the bit move unit 24, or bit data (for example of 1 bit per pixel) converted into an image from text code data, mixed data or character code data obtained by key entry or word processing. The mixed data include both bit image data and character code data in a page. These data are divided into image blocks

and character blocks, each of which is given an identification code for administration and storage. The image memory 25 is also utilized as a buffer for temporarily storing predetermined data, thereby matching the speed of the reader 10, printer 70 and communication channel 40.

The video random access memory (VRAM) 26 is provided for storing image data to be displayed on the cathode ray tube 60 by a bit map data for example of a bit per pixel.

As non-volatile external memories there are provided a rigid (hard) disk memory 50 and a floppy disk memory 51, which may be replaced by another non-volatile backup memory, for storing data to be transmitted or data received.

A keyboard 61 is provided for entering command data for transmission or reception, command data for word processing or image processing, and character data for word processing.

A pointing device 62 is used for moving a cursor image on the cathode ray tube 60, thus designating a position for image processing etc. Also the device 62 is used for block designation of mixed data. Coordinates indicating the blocks are stored and administered by the program memory (PMEM) and treated as a part of identification code data or header at data transmission.

For high-speed transmission of a large amount

of image data with a high resolving power (density), the communication channel 40 is preferably composed of a digital channel, for example a digital data network or a digital data packet network, of for example 64 Kbit/sec.

The printer 70 is composed of a laser beam printer capable of data printing at a rate of 3 Mbps.

Fig. 3 shows a page of mixed data divided into blocks 1 - 8, corresponding to the display frame of a page on the cathode ray tube 60, to the data of one page at data transmission, or to the print sheet of a page at the printing of received data. In case of preparing such mixed data of plural pages, storing the same in the rigid disk 50 and transmitting the data at a time, header data 1 - n are attached in front of block data 1 - n as shown in Fig. 4, and each header indicates whether succeeding block data are image data or character data, the size of the block data, and the position thereof in a page. Signal A is an acknowledge signal for transmission or reception of block data, and a signal EOP is emitted when the transmission of a page is completed.

Data of a page of the original from the reader 10 are stored in the image memory 25, then transferred to the VRAM 26 and displayed on the cathode ray tube 60. The image thus displayed is trimmed, through the bit move unit 24 according to editing instructions given by the keyboard 61 or the pointing device 62, to obtain an image corresponding to a block 3, which is again stored in the

memory 25.

Text code data from the keyboard 61 are stored in the memory 23, then converted into bit data, transferred to the VRAM 26 and displayed, as a text of one page, on the cathode ray tube 60. The data are edited in the same manner as the image processing to obtain character data corresponding to blocks 1 - 6 shown in Fig. 3, and again stored in the memory 23, in the form of codes. Position data of each block are controlled, together with the attribute of data, in the memory 23. Then, in response to a next command, image data and position data of the blocks 7, 8 of the memory 25 are read and displayed, through the VRAM, in the position of the block 3 on the cathode ray tube 60, thus finally providing a display of blocks 1 - 8 shown in Fig. 3. These mixed data are read from the memories 23, 25 in the order of blocks 1 - 8 and are stored in the rigid disk 50.

Fig. 3(c) shows an example of the document of a page after editing, wherein blocks 1 to 6 are character code blocks, and blocks 7, 8 are bit image blocks.

Thus there is required a large number of blocks in transmission if character code blocks and bit image blocks are mixed in the document.

These blocks can however be converted into two blocks 9, 10 as shown in Figs. 3(a) and 3(b).

Fig. 3(a) shows the code block 9, in which an area corresponding to the block 7 need not be filled

with codes since it is positioned at the end of lines, but, in an area corresponding to the block 8, spaces between character codes are filled in with blank codes such as space or tabulator codes.

Fig. 3(b) shows the bit image block 10 which is selected as a smallest rectangular block at least including the blocks 7 and 8, but there may be employed any rectangular block without limitation in size. An area corresponding to the character code block shown in Fig. 3(c) is totally filled with white bits.

Fig. 5 is a flow chart for block conversion. At first a document as shown in Fig. 3(c) is obtained by combining the bit image data from the reader 10 and the code data from the keyboard 61 on the cathode ray tube 60 through a process as explained before, and there are entered a code indicating the boundary of block (for example indicating a starting coordinate of the block and the dimension thereof) and an attribute code indicating the nature of the block. Then there is discriminated, from the attribute code, whether a character code block is present (2), then, if present, there is discriminated whether plural blocks are present (3), and, if plural blocks are present, the block area 8 between such plural blocks is filled with space codes (4). The block 7 need not be filled with the space codes because return codes are present at the boundary with the block 2. Then a block consisting solely of character codes is obtained

by deleting such codes indicating the block boundary and changing the attribute of the block and is stored in the PMEM (5).

Subsequently there is discriminated where a bit image block is present (6), then, if present, there is discriminated whether plural blocks are present (7), and, if plural blocks are present, the space between the blocks is filled with white bits (8). Subsequently the attribute of the block is changed by deleting the codes indicating the boundary of the blocks, and a block consisting solely of bit images is stored in the IMEM (9). Then there is discriminated whether plural blocks are present in total (10). As there are the character code block 9 and image block 10 in this case, an overlapping attribute code is set in the PMEM, instructing to overlay these blocks, taking a point A of the block 9 as the reference. Then, in response to the entry of a transmission instruction, there are emitted, in succession, said overlapping attribute code, code data and bit image data respectively stored in the PMEM and IMEM. The attribute code may be transmitted after the transmission of the document data.

At the receiving side, the transmitted data of blocks 9, 10 are stored in the disk 50, and transferred to the PMEM and IMEM. Then the overlapping attribute code transmitted before or after the data reception, then the data of the block 9 are converted into bit image data by a character generator, while the encoded

data of the block 10 are decoded into bit image data by a decoder, and the data of these blocks are superposed with the point A as the reference to reproduce the transmitted next shown in Fig. 3(c), on the cathode ray tube 60 or on the printer 70.

Fig. 6(c) shows a document which contains, between character code blocks 11 and 13, a block 12 in which character codes and bit image data are overlapped. The block 12 can be divided, for transmission, into a code block 12-1 and a bit image block 12-2 of a same size. In this case there will be required four blocks, but a higher efficiency of transmission can be attained in comparison with a case of further dividing the block 12 into overlapped blocks and non-overlapped blocks. In this case an overlapping attribute code is attached to the block 12 while the boundary and attribute thereof are retained, and, at the receiving side, the original text is regenerated by superposing the transmitted blocks 12-1, 12-2 only.

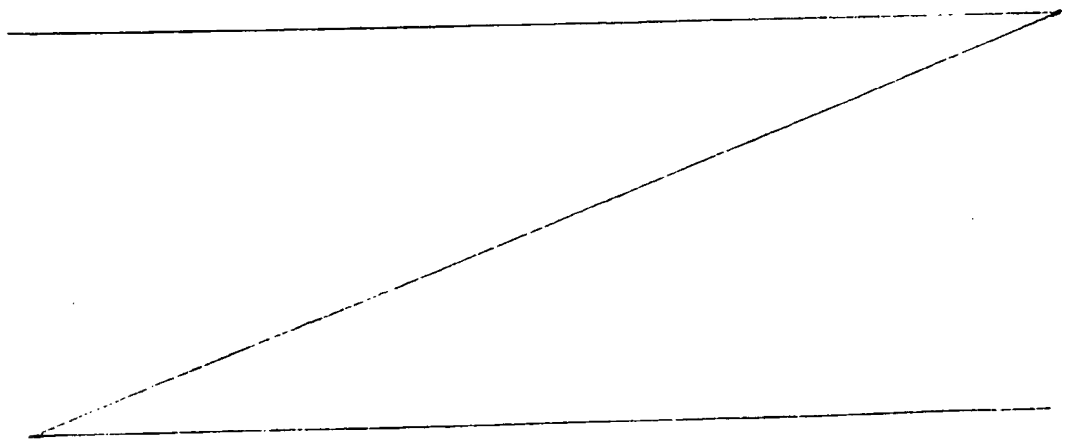


Fig. 6(a) and 6(b) show two blocks, i.e. a character code block 14 and a bit image block 15 constituting one page of the text (c) including an overlapped block. Also in this case, as explained before, the boundary of the blocks is eliminated, then an overlapping attribute code, indicating an overlay with a reference point B, is given, and transmission is effected. At the receiving side, the data of the blocks 14, 15 are synthesized according to the attribute code, and the text thus obtained is displayed or printed.

It is also possible to develop the code block 12-1 of the overlapping block 12 into bit image data in the program memory PMEM, then overlaying the data with the bit image data of the image block 12-2 and storing thus obtained image pattern (c) into the image memory IMEM. In this case there are required only three blocks 11, 12, 13 because the boundary and attribute of the code block 12-1 are eliminated, so that a higher transmission efficiency can be attained. The boundary and attribute of the block 12 are same as those of the bit image block 12-2. The boundary position and attribute code of the blocks 11 - 13 are contained in the headers C, I of the blocks shown in Fig. 4.

In the following there will be explained optimum division of transmitting blocks. Figs. 7A to 7E illustrate examples of division of a text of one page containing a character code data area C and an image

data area I.

In the example shown in Fig. 7A, the character code area is divided into blocks C1, C2 while the image area is taken as a block I1, without transparent overlapping. In this case the transmission is effected in three blocks C1, C2 and I1. The starting points and sizes of the blocks can be defined by the coordinates of the points P1 and P2.

In the example shown in Fig. 7B, a character code block C'1 and an image block I1 are subjected to transparent overlapping. In the block C'1, an area outside C1 have no character code data, but the return codes at the ends of character rows of the area C1. In this case the transmission is conducted in three blocks C'1, C2 and I1.

In the example shown in Fig. 7C, the character areas C1, C2 are unified as a one-page block CA which is subjected to transparent overlapping with the image area I1. In this case the transmission is conducted by a page CA and a block I1.

In the example shown in Fig. 7D, the character area C1, C2 and the image area I1 are respectively unified as pages CA and IA which are subjected to transparent overlapping. In this case the transmission is conducted in two pages. The transmission efficiencies in these examples are variable, but, in the present example where characters represent a considerable area,

a transmission with a page of character codes and a block of image shown in Fig. 7C is estimated efficient because the header codes for the blocks C1, C2 can be dispensed with.

The example shown in Fig. 7D also does not require header codes of the blocks, but during image formation IA, an area outside the area I1 has to be filled with uniform white or black data, which increases the amount of information even when compressed. Consequently this case is considered disadvantageous.

However, if two blocks I1, I2 almost occupy a page as shown in Fig. 7E, there may become advantageous the two-page transmission shown in Fig. 7D, wherein I1 and I2 are considered as a group 1 and C1 to C3 are considered as a group 2.

In this manner the selection of division becomes different according to the nature and distribution of the information.

In order to identify an optimum division the total amounts of data in various divisions are calculated and compared, and the transmission is conducted according a method of division giving a minimum amount of information.

Fig. 8 shows a flow chart of a procedure for such identification.

At first a step S-0 sets "4" as the number n of division of one-page data corresponding to a frame of

the cathode ray tube as shown in Fig. 7. A step S-1 effects an area division shown in Fig. 7A, and determines the amounts of data C1m, C2m respectively corresponding to the code data of the block C1 and those of the block C2 in the program memory PMEM, according to the position data P1, P2 at the aforementioned text editing. The data amounts can be obtained from the memory address to the position P2, stored in advance in the memory PMEM. Then a step S-2 compresses the bit data corresponding to the block I1 in the image memory IMEM by means of the ICU 22 to obtain the compressed data amount I1m. Then the total amount of data M1 = C1m + C2m + I1m is determined and stored in the program memory PMEM. The compressed data are temporarily stored in the rigid disk 50.

Subsequently the program returns to the step S-1 to effect the division of Fig. 7B, thus determining the amount of data corresponding to the block C'1. In this case the amount is almost same as that of the block C1 shown in Fig. 7A. The obtained amount of data is M2 in this case.

Then there is effected the division shown in Fig. 7C to obtain the data amount corresponding to the block CA, with the total data amount M3.

Then there is effected the division shown in Fig. 7D to obtain the data amount corresponding to the block IA. In the block, the amount of data is obtained

by adding, to Ilm, the amount of data obtained by compressing white bits outside the block Il. The total data amount in this case is M4.

The number n of divisions is already set as 4. A step S-3 effects a decrement from the number n for each calculation of the total data amount, and a step S-4 discriminates whether the number has reached zero. Then a step S-5 compares the total amounts of data Ml - M4 to determine the dividing mode giving the minimum data amount.

Subsequently the page data are divided according to thus determined dividing mode and are stored in the rigid disk, and thus divided blocks are transmitted in succession in response to the transmission command.

In the foregoing explanation the dividing mode is determined according to the total amount of data, but, if the total amount of data does not vary significantly as in the cases shown in Figs. 7B and 7C, the mode is preferably determined according to the number of blocks since the transmission of two blocks may be more advantageous in efficiency than the transmission of three blocks. The number of blocks is stored for each of the divisions shown in Figs. 7A to 7D. It is also possible to achieve block division by manually selecting one of such dividing modes.

In the foregoing there has been explained a mode of determining an appropriate division in response

to a transmission command and automatically effecting transmission upon completion of the divison, but it is also possible to effect an appropriate division in response to a preliminary command, then to provide a display of the appropriate division and to effect transmission in response to a transmission command given thereafter.

Also as another embodiment it is possible to normally effect a standard block division as shown in Fig. 7A, but, in case the number of blocks exceeds a predetermined maximum number, for example 31, to focedly select a dividing mode in which the number of blocks becomes less than the maximum level. In such case a discrimination is made as to whether the number of blocks exceeds a maximum number MAX as shown in Fig. 8B, and, if the maximum number is exceeded, a flow chart shown in Fig. 8A is executed to determine an optimum dividing mode from the amounts of information in various dividing modes not exceeding the maximum number. In this manner the time required for preliminary process prior to transmission can be shortened.

In the following there will be explained an embodiment provided with a character recognizing function in addition to the above-explained functions.

Also in this embodiment the structure is same as that shown in Fig. 1. Data of an original text read by the reader 10 are stored in the image memory 25,

then subjected to character recognition by the CPU 27 and a corresponding code is allotted to each recognized character. The character recognition can be conducted by an already known process. In such character recognition of the original, certain characters may remain unrecognizable. There will be required a large number of blocks if such unrecognized characters are transmitted as image data of respectively different blocks. In the present embodiment, therefore, the recognized characters are transmitted as code block as shown in Fig. 3, while the unrecognized characters are transmitted as a bit image block, and both are overlaid at the receiving side.

Fig. 9 shows an example of the fourth embodiment. In the character recognition of an original text shown in Fig. 9(a), it is assumed that two groups of characters remain unrecognized. In the code block shown in Fig. 9(b), blank codes are given to the unrecognized characters.

Fig. 10 is a flow chart showing the control procedure of the CPU 27 in the fourth embodiment.

Now referring to Fig. 10, a step S1 causes the CPU 27 to store the bit image data of the original text, read by the reader 10, into the image memory 25. Succeeding steps S2 - S6 effect character recognition character by character. In the character recognition, the bit image data stored in the image memory 25 are

at first scanned to recognize a character row, and, upon completion of the recognition, each character column is recognized. In this manner the bit image data of the original text are divided into rows and columns of characters, and each character is then recognized. However the character recognition is not necessarily limited to the process of the present embodiment but may be conducted in various methods.

Steps S-2 and S-3 effect recognition of a character, and a step S-4 stores a corresponding character code into a code block area of the program memory 23 if the character is recognized, or, if the character is unrecognized, stores a space code in the code block area and the bit image data of the unrecognized character in a bit image preparation area of the memory 23, at an address of the unrecognized character. The program memory (PMEM) 23 is provided with a code block area, a bit image preparation area, and a bit image block area. The code block area and the bit image preparation area are respectively provided with addresses of a number of divisions for character recognition (character rows x character columns). The bit image of a character to be recognized is given size information (a, b) of the character bit image block as shown in Fig. 9(c).

When a succeeding step S-6 identifies the completion of recognition of all the characters, a step S-7 discriminates the presence of unrecognizable characters.

If the step S-7 identifies the absence of such unrecognizable characters, a step S-8 attaches information of address and size of the code block, for example (x, y) and (x', y') shown in Fig. 9(b), information indicating the arrangement of characters and identification data indicating a code block, in front of the data of the code block area in the program memory 23, and the transmission is conducted as code block data.

On the other hand, if the step S-7 identifies the presence of unrecognizable characters, steps S-9 to S-12 read the minimum address $x_{min} = x_1$, $y_{min} = y_1$, and the maximum address $x_{max} = x_n$, $y_{max} = y_n$ (see Fig. 9(c)) of the bit image data of the unrecognizable characters in the bit image preparation area of the program memory 23, and steps S-13 to S-15 prepare a bit image block. At first the step S-13 sets the address of the starting point (x_{min}, y_{min}) of the bit image block and the size information ($x_{max}+a-x_{min}$, $y_{max}+b-y_{min}$), and the step S-14 sets identification information indicating that the block is bit image data and an overlap attribute indicating that the block is to be overlapped with the code block. Then the step S-15 stores the bit image data of the bit image preparation area respectively in the areas of unrecognizable characters in the bit image block area, thus obtaining bit image data as shown in the bit image block in

Fig. 9(c).

The bit image data thus prepared in the step S-15 are stored as bit image block data in the program memory 23, together with the information set in the steps S-13 and S-14. In this operation, the bit image data may be encoded by the ICU 22.

Then a step S-16 adds, to the code data in the code block area, address information and size information of the code block, identification information and information indicating the arrangement of characters, then stores thus obtained code block data in the program memory 23, and transmits the code block and the bit image block to the destination.

As explained in the foregoing, the fourth embodiment effects encoding of characters by character recognition, and is therefore capable of saving manpower in comparison with the character input through the keyboard 61, thus reducing the time required for communication. Besides the unrecognized characters are transmitted in bit image data to achieve secure transmission of the original data. Furthermore the recognized characters and unrecognized characters are respectively transmitted in a code block and a bit image block, so that the number of block is reduced in comparision with the case of dividing the data into plural blocks. In addition the data communication time is therefore reduced and the data processing at the

transmitting and receiving sides is simplified. Furthermore, the above-mentioned code block obtained by character recognition may include code data of a text prepared by a word processor.

Examples of different data include graphic code data, character code data, line image bit data, halftone image data etc.

WHAT WE CLAIMED IS:

1. A data communication process for transmitting two or more data in mixed manner, which comprises transmitting said data in appropriately divided data blocks.

2. A data communication process according to Claim 1, wherein said appropriate division is determined according to the amount of data of the blocks.

3. A data communication process according to Claim 1, wherein said appropriate division is determined according to the number of divisions.

4. A data communication process according to Claim 1, wherein said division into blocks is determined by arbitrarily selecting one of dividing modes.

5. A data communication process for transmitting and/or receiving character codes and bit images, which comprises transmitting separately a first block composed of character codes, a second block composed of bit images and a third block composed of data in which character codes and bit images are overlapped.

6. A data communication process according to Claim 1, wherein transmission is conducted after

elimination of the boundary between the third block and the first or second block.

7. A communication terminal apparatus for transmitting and/or receiving character codes and bit images, which comprises transmitting or receiving information, composed of respectively plural blocks of character code blocks and bit image blocks, by constituting a page with blocks of a number less than the number of above-mentioned blocks.

8. A data transmission process for transmitting two or more data in mixed manner, which comprises reading and converting information into first and second data and transmitting thus obtained blocks.

FIG. 1

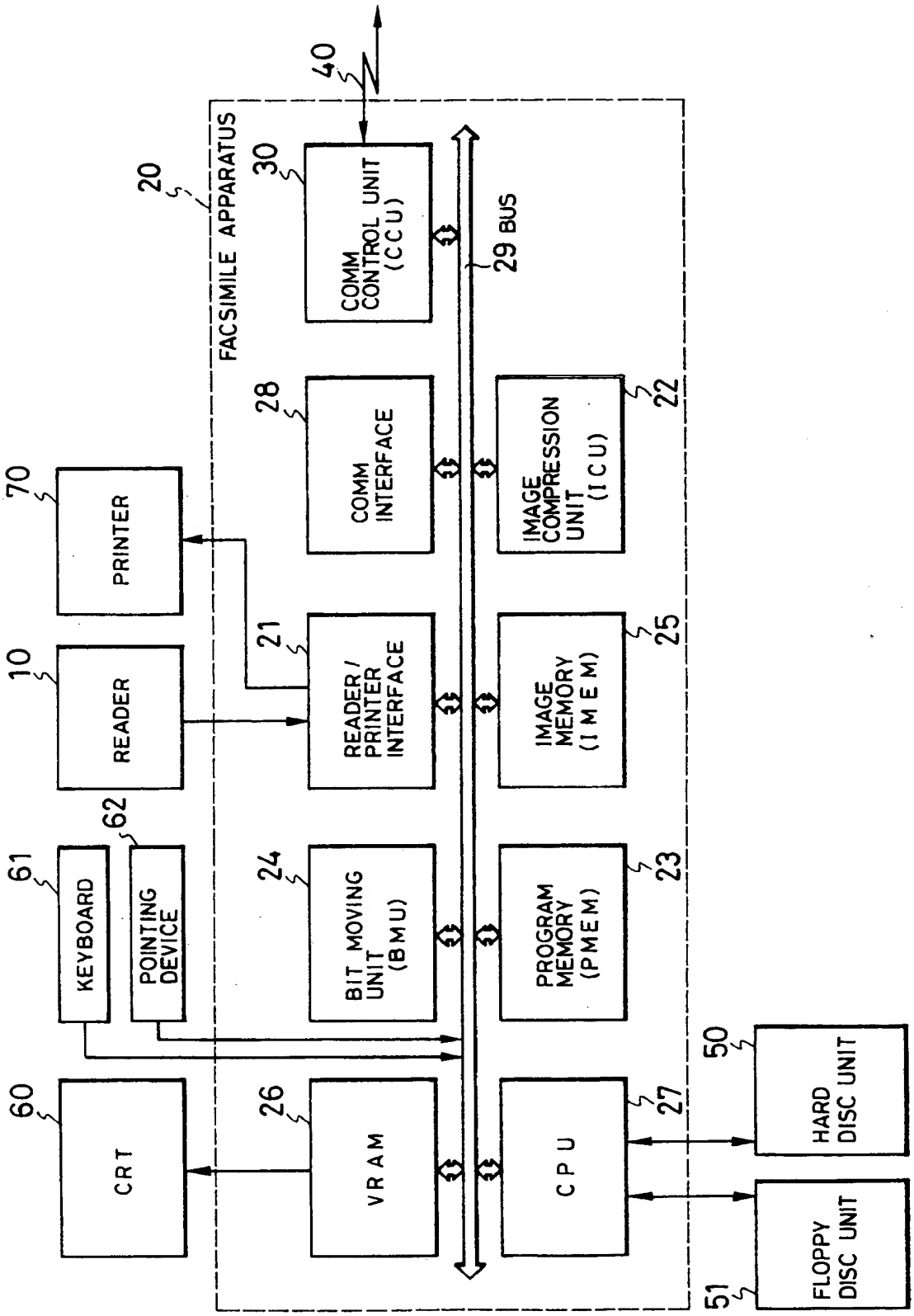


FIG. 2

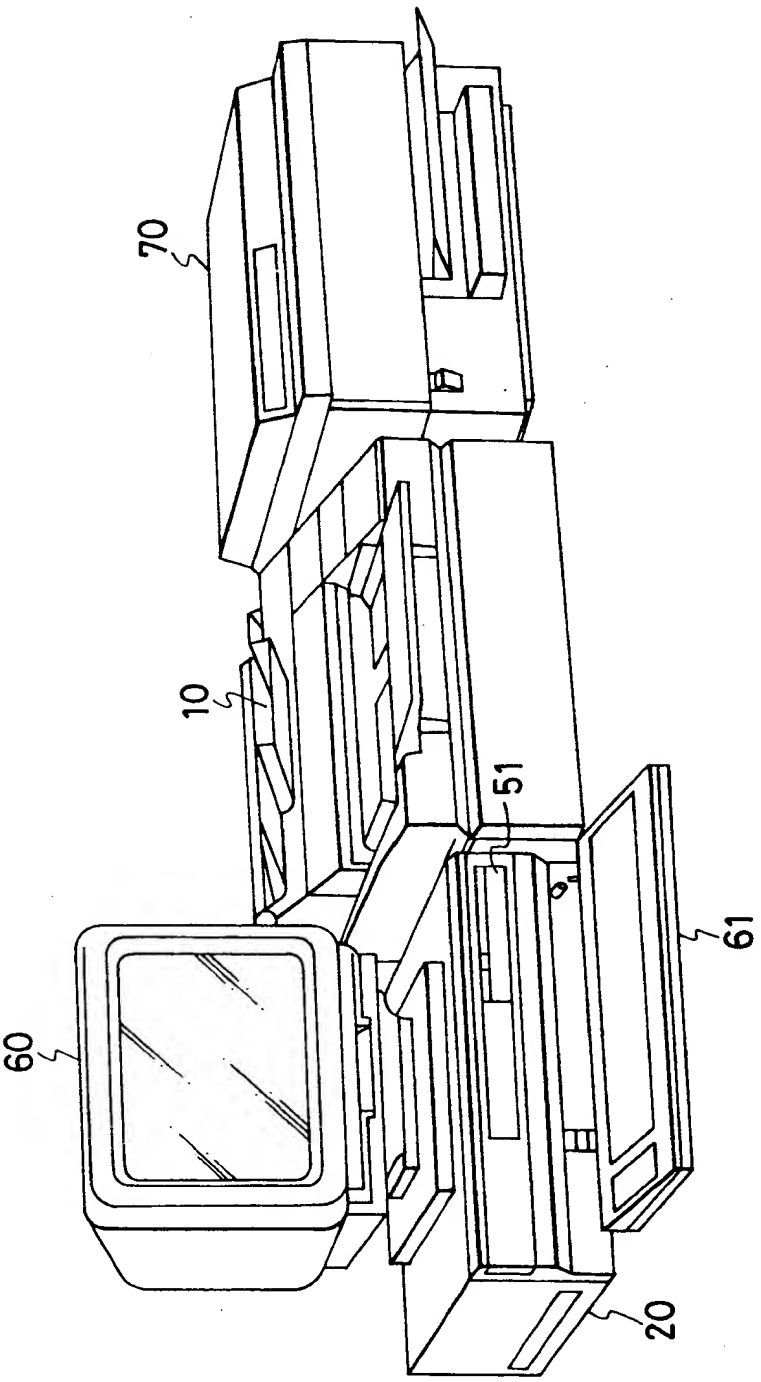


FIG. 3

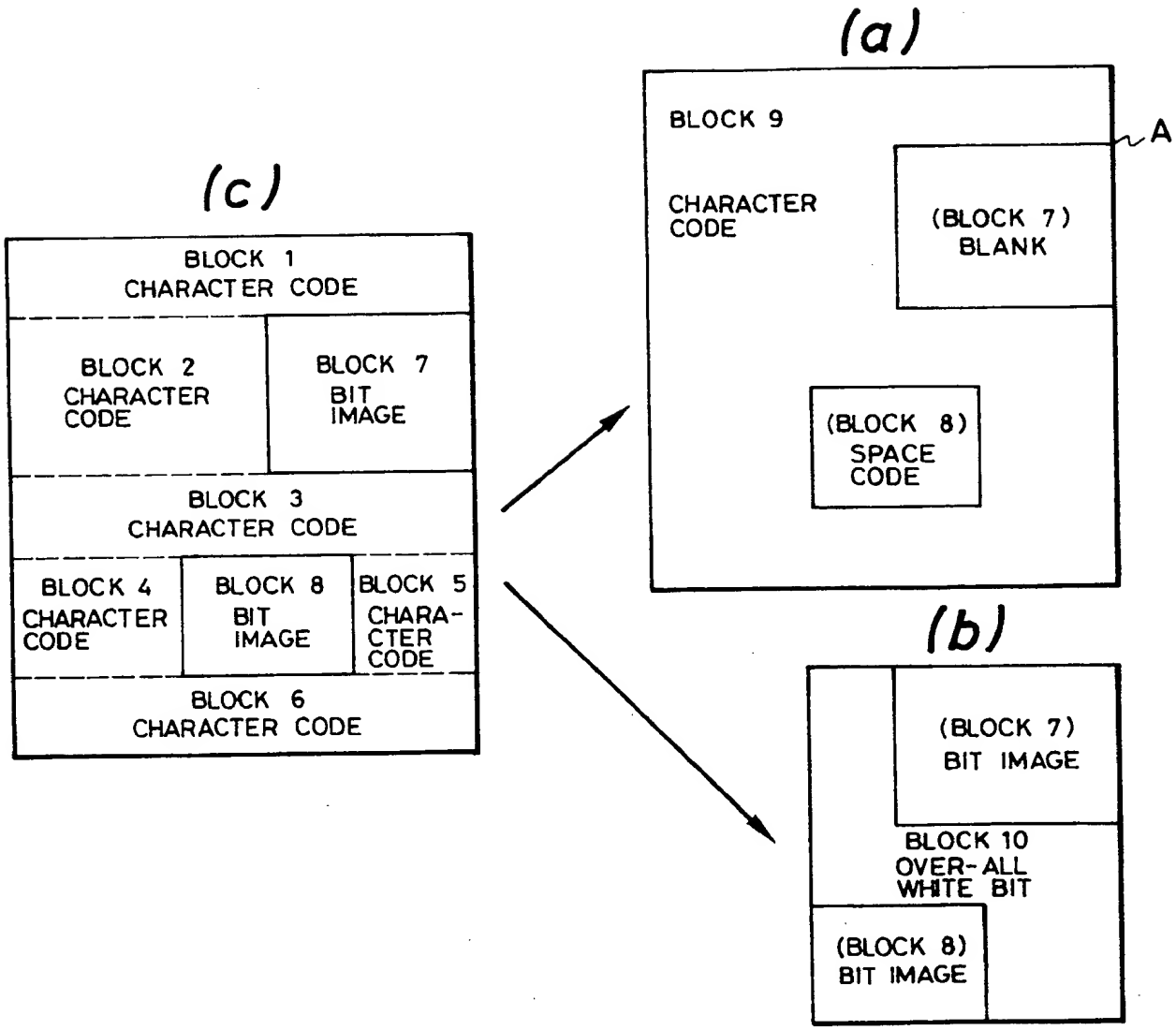


FIG. 4A

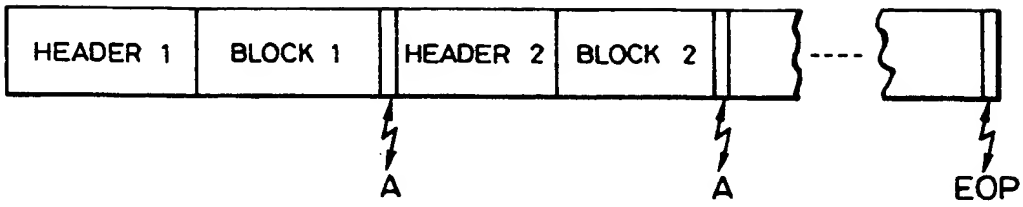


FIG. 4B

FIG. 4C

FIG. 6

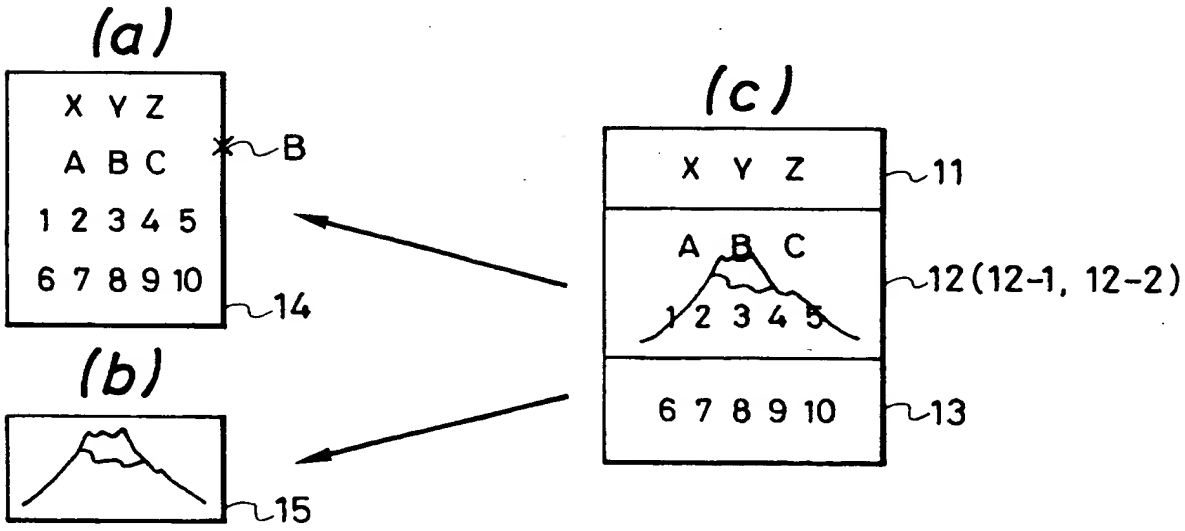


FIG. 5

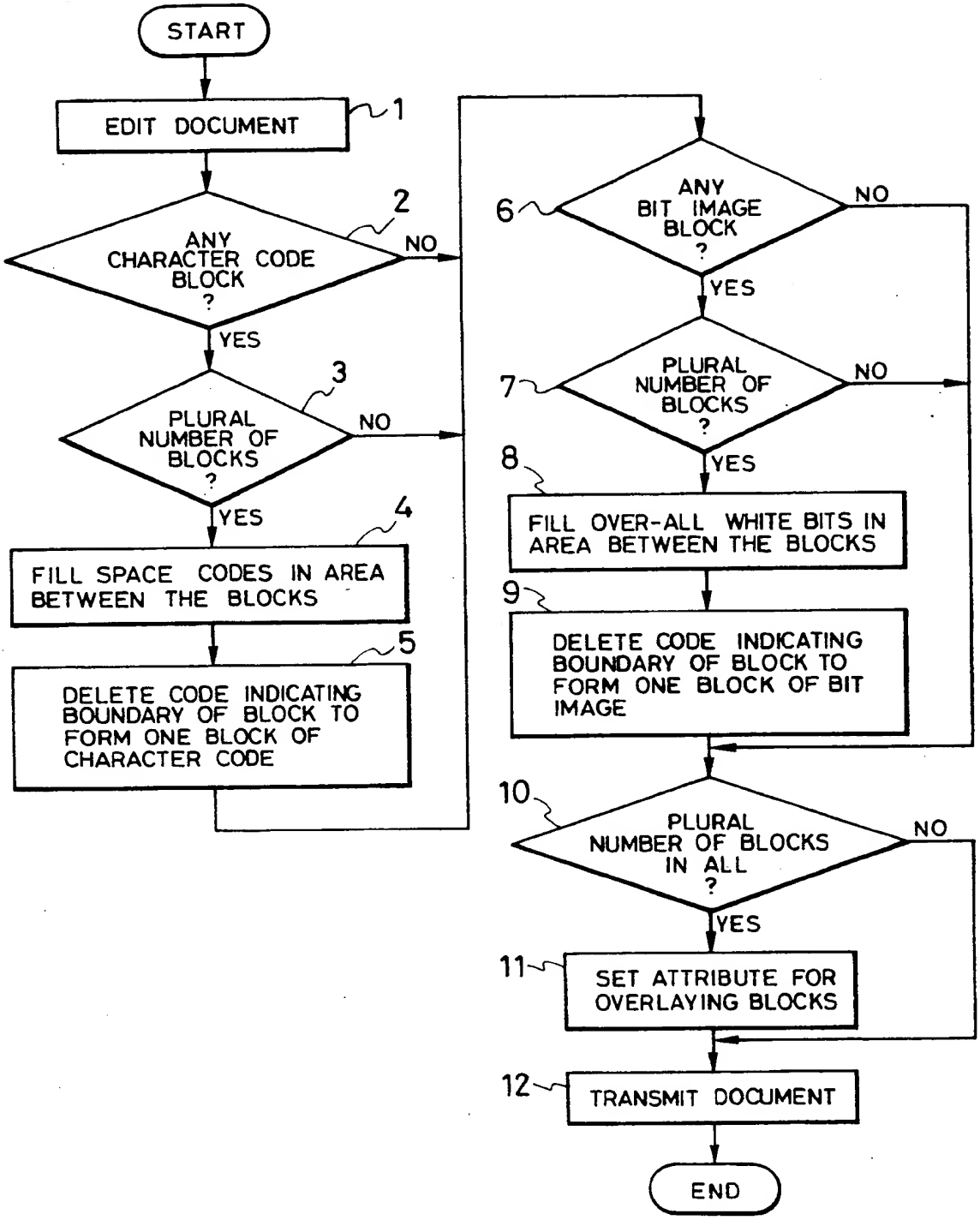
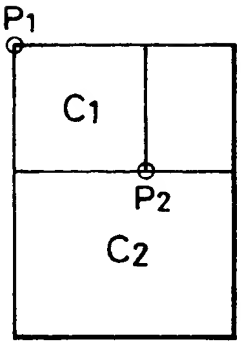


FIG. 7A (a)



(b)

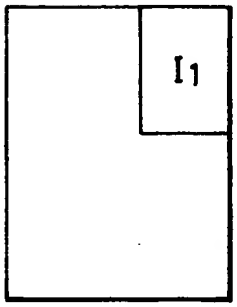
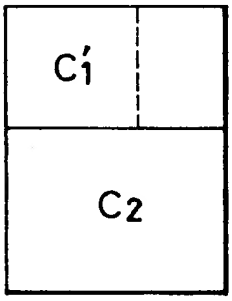


FIG. 7B (a)



(b)

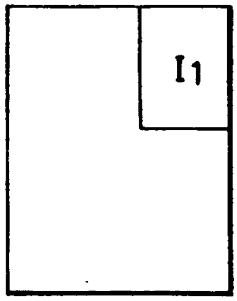
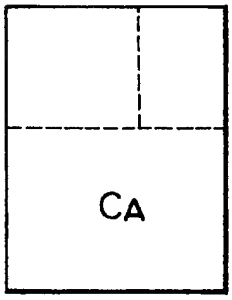


FIG. 7C (a)



(b)

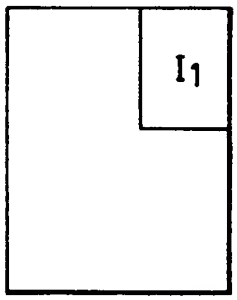
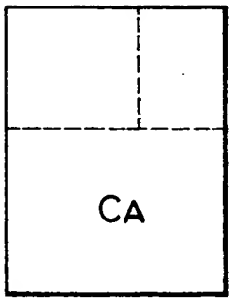


FIG. 7D (a)



(b)

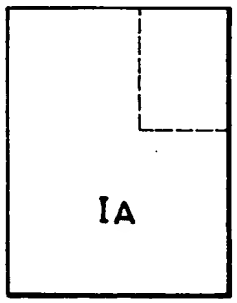


FIG. 7E

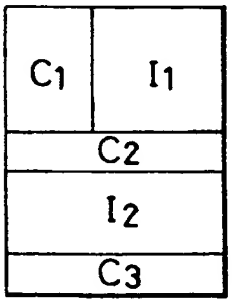


FIG. 8A

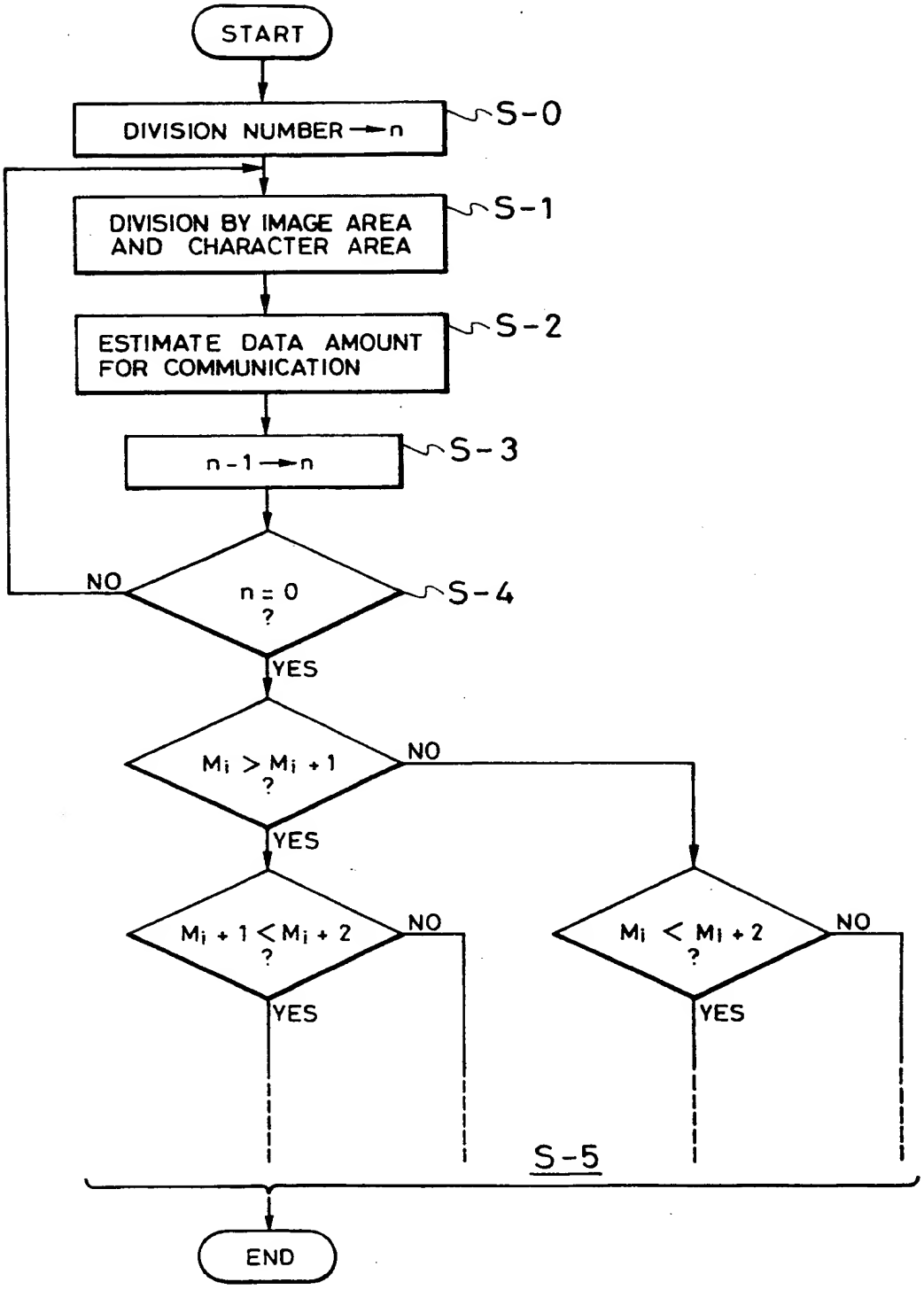


FIG. 8B

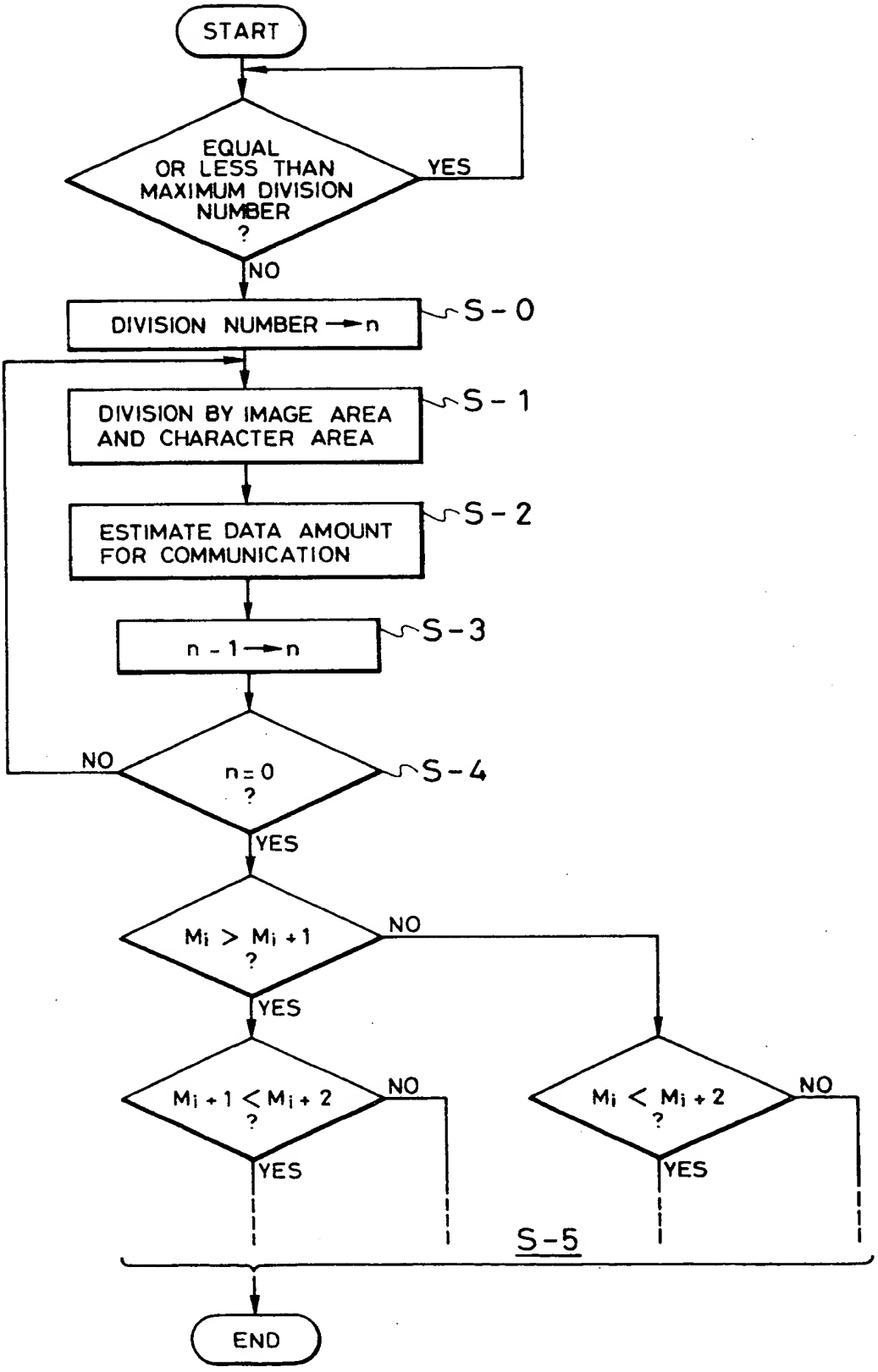
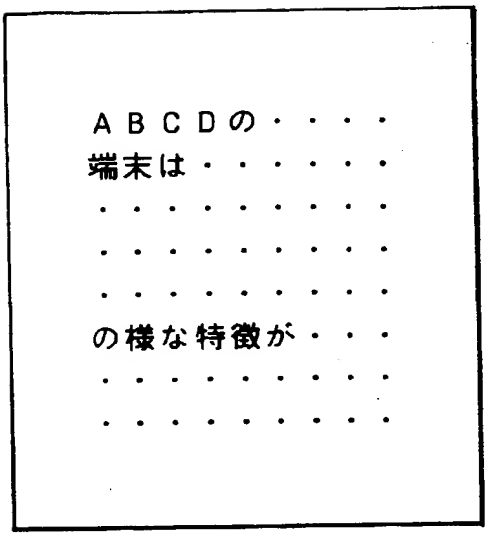
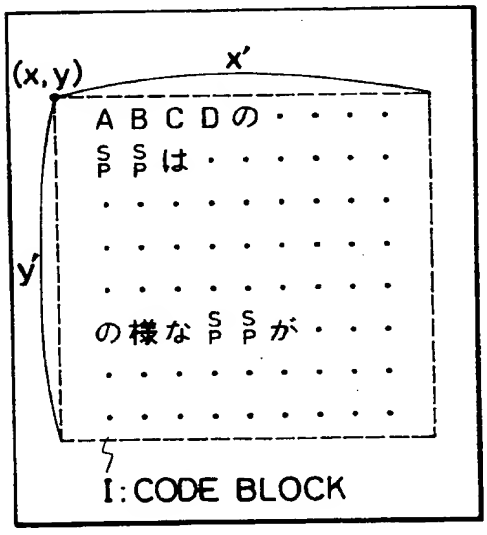


FIG. 9

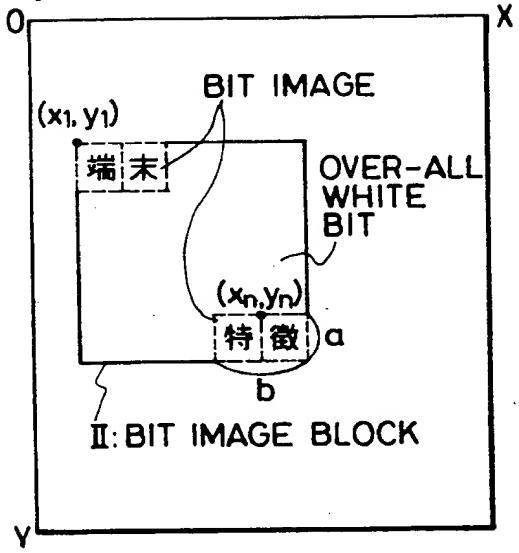
(a)



(b)

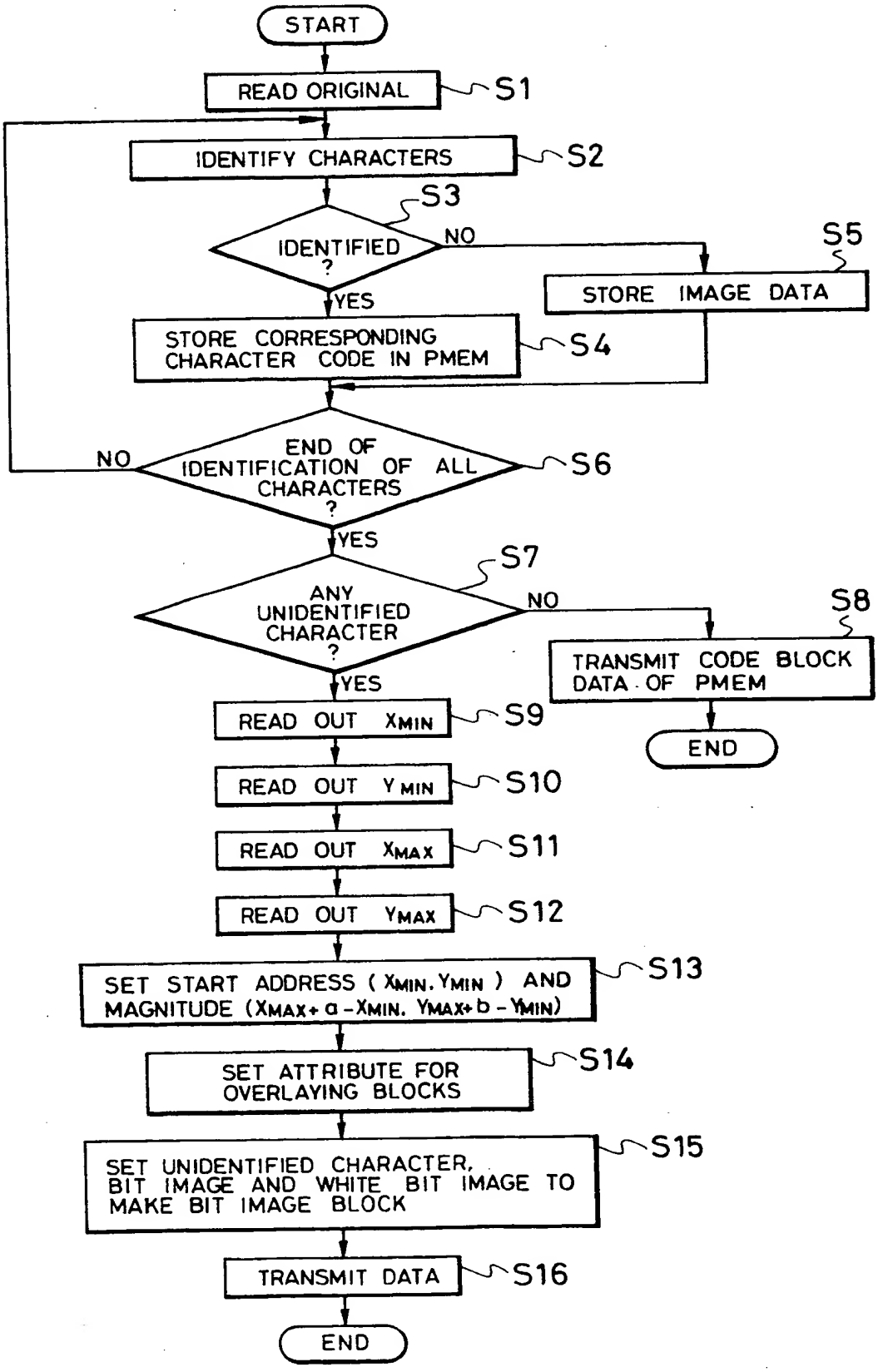


(c)



"SP" REPRESENTS BLANK CODE

FIG. 10



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(54) **Data communication process and apparatus therefor.**

(57) There is disclosed a process for transmitting mixed data, composed of character code data and bit image data in blocks and an apparatus therefor. Efficient transmission can be achieved by selecting the size of blocks suitably according to the quantity of data in each block or the number of blocks.

EP 0 218 448 A3

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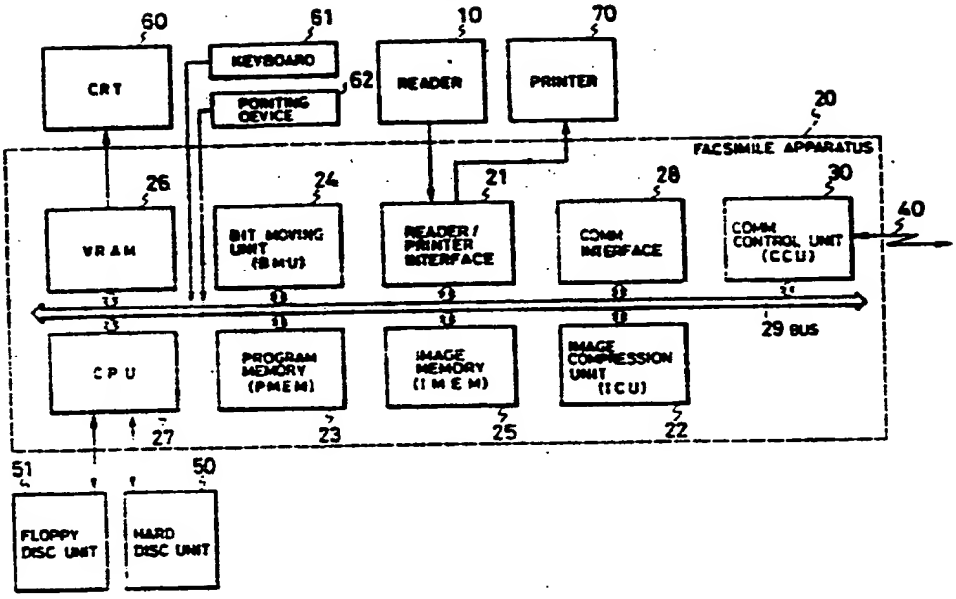
FIG. 1



0218448

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 86 30 7490

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	EP-A-0 029 327 (XEROX) * page 1, line 1 - page 3, line 5; page 49, line 9 - page 64, line 10; figures 37-44 *	1-4	H 04 N 1/40 H 04 N 1/387
A		5-8	
A	EP-A-0 081 767 (TOSHIBA) * page 1, line 3 - page 5, line 8; figures 1, 2 *	1-8	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

H 04 N 1/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	18-08-1987	DUDLEY C.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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& : member of the same patent family, corresponding document

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Remarks:
This application was filed on 28 - 05 - 1996 as a divisional application to the application mentioned under INID code 62.

(54) Communication system and method for transmitting data of different types

(57) The invention relates to a communication system in which transmission takes place according to a format which permits different types of data to be combined and transmitted within a single transmission. The novel feature is that the communication system transmits variable length frames of data in packets, and that a data combining and transmission sub-system (14, 16, 18, 20) is provided so that when a frame of data does not require a complete packet for transmission, the data combining sub-system combines the frame of data with additional data to provide a complete packet. The data combining sub-system comprises input means for receiving the frame of data and the additional data and for combining the frame of data and the additional data to provide a complete packet responsive to a control signal, and control means for providing the control signal.

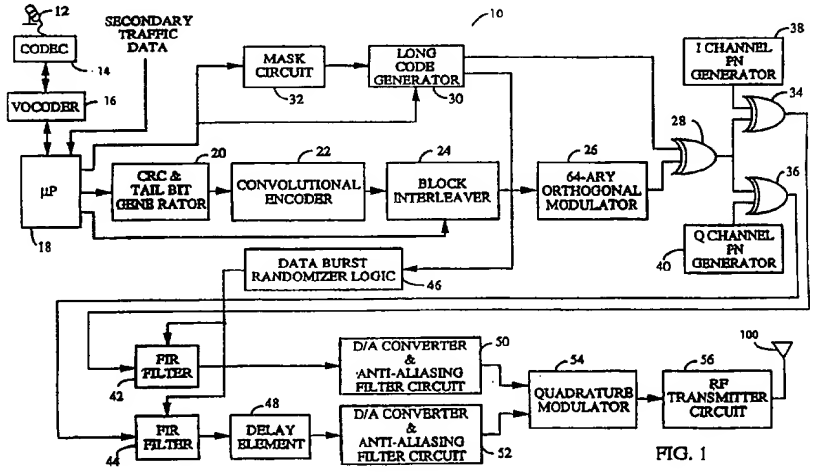


FIG. 1

EP 0 730 356 A2

Description

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present application relates to the organization of data for transmission. More particularly, the present invention relates to a novel and improved method and apparatus for formatting vocoder data, non-vocoder data and signaling data for transmission.

II. Description of the Related Art

In the field of digital communications various arrangements of digital data for transmission are used. The data bits are organized according to commonly used formats for transfer over the communication medium.

It is therefore an object of the present invention to provide a data format which facilitates the communication of various types of data, and data of various rates, to be communicated in a structured form.

US-A-4,291,409 discloses a method and apparatus employing spread spectrum techniques in a wide bandwidth communications system. A plurality of transmitting stations are each equipped to provide a transmission signal representing a pseudo-random coded, phase modulated, message signal. The transmission signal is directed through a bandwidth which encompasses otherwise dedicated, relatively narrow bandwidth repeater channels, employed in connection with a communications satellite, to a generally fixed receiver station. At the receiving station, the incoming signal is (a) code acquired and tracked, (b) carrier acquired and tracked, (c) phase locked to the receiver local oscillator and (d) coherently demodulated to extract the desired data. The receiving station advantageously employs plural receiving elements each having a pseudo-random sequence code matched filter which significantly reduces code acquisition time by obviating the necessity of exhaustively correlating the incoming signal with a replica of the pseudo-random code word at the receiver station.

EP-A2-0 412 583 discloses a time division multiple access (TDMA) communication device controller, which controls all signaling, synchronization and supervisory functions. In one embodiment, the invention operates to control a remote communication device having a vocoder and buffering means. The remote communication device is enabled to operate as a dispatch, full duplex or a combination dispatch/full duplex communication device. In another embodiment, a primary station (repeater) is controlled to operate as a single frequency repeater (SFR) or as a multi-frequency TDMA repeater. A communication channel is divided into time sub-slots which may be allocated to different users. The number of sub-slots allocated to a given user depends on the quality of speech required by the user. At the beginning of a call the user selects the required quality of speech. For the duration of the call the speech is encoded at that fixed rate. The encoded speech is provided to a buffer. The buffer is capable of holding enough encoded data to fill a time sub-slot. As soon as the buffer is filled the data is entered into the sub-slot for transmission. If the user wants to provide speech and digital data, this need is specified prior to transmission. The communication system then provides enough sub-slots to carry the fixed rate speech data and also provides additional sub-slots to carry the fixed rate digital data. When the call is completed the caller is billed in accordance with the number of sub-slots used.

WO 91/07030 discloses a distributed synchronization method for a wireless fast packet communication system. The distributed synchronization method, according to the invention, provides for the combination of both voice and data in a single switch using a common packet structure. It allows for the dynamic synchronization of packets. This includes not only bandwidth within the voice or data areas of the frame, but also between the voice and data portions.

The method includes generating a set of tail bits for being appended to data in a frame.

SUMMARY OF THE INVENTION

The present invention is a novel and improved method and system for formatting digital data for communication over a transmission medium.

In communication systems it is important to utilize a data format which permits a full communication of data between users. In a communication system, such as a code division multiple access (CDMA) communication system, in which it is desirable to communicate various types of data, and at various rates, a data format must be selected which permits maximum flexibility within a predefined structure. Furthermore to maximize resources it is desirable to permit a sharing of the format to permit different types of data to be organized together. In such situations it is necessary to structure the data in a manner in which it may be readily extracted according to the corresponding type and rate.

A method and apparatus is provided for arranging various types of data, and at various rates, into a uniquely structured format for transmission. Data is provided as vocoder data or different types of non-vocoder data. The data is organized into frames of a predetermined time duration for transmission. The data frames are organized, depending on the data, to be at one of several data rates. Vocoder data is provided at one of several data rates and is organized in

the frame according to a predetermined format. Frames may be formatted with a sharing of vocoder data with non-vocoder data to be at a highest frame data rate. Non-vocoder data may be organized so as to also be at a highest frame rate. Additional control data may be provided within the data frames to support various aspects of the transmission and recovery upon reception.

The invention in its widest aspect is set forth in Claims 1 and 9 written with regard to EP-A2-0 412 583 as nearest prior art.]

BRIEF DESCRIPTION OF THE DRAWINGS

The features, objects, and advantages of the present invention will become more apparent from the detailed description set forth below when taken in conjunction with the drawings in which like reference characters identify correspondingly throughout and wherein:

Figure 1 is a block diagram illustrating an exemplary embodiment for a transmitter portion of a transceiver;

Figures 2a - 2h are a series of diagrams illustrating frame data formats for the various data rates, types and modes;

Figure 3 is a diagram illustrating an exemplary circuit implementation of the CRC and Tail Bit generator of Figure 1;

Figures 4a - 4e is a flow chart of the formatting of frames of data;

Figures 5a - 5d illustrate in a series of charts the ordering of code symbols in the interleaver array for transmission data rates of 9.6, 4.8, 2.4 and 1.2 kbps, respectively;

Figures 6a - 6c is a chart illustrating the Walsh symbol corresponding to each encoder symbol group;

Figure 7 is a block diagram illustrating the long code generator of Figure 1;

Figures 8a - 8c are a series of diagrams illustrating long code masks for the various channel type; and

Figure 9 is a graph illustrating the frequency response of the digital filters of Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, Figure 1 illustrates an exemplary embodiment of a transmit portion 10 of a CDMA mobile station transceiver or PCN handset. In a CDMA cellular communication system a forward CDMA channel is used to transmit information from a cell base station to the mobile station. Conversely a reverse CDMA channel is used to transmit information from the mobile station to the cell base station. The communication of signals from the mobile station may be characterized in the form of an access channel or a traffic channel communication. The access channel is used for short signaling messages such as call originations, responses to pages, and registrations. The traffic channel is used to communicate (1) primary traffic, typically includes user speech, or (2) secondary traffic, typically user data, or (3) signaling traffic, such as command and control signals, or (4) a combination of primary traffic and secondary traffic or (5) a combination of primary traffic and signaling traffic.

Transmit portion 10 enables data to be transmitted on the reverse CDMA channel at data rates of 9.6 kbps, 4.8 kbps, 2.4 kbps or 1.2 kbps. Transmissions on the reverse traffic channel may be at any of these data rates while transmissions on the access channel are at the 4.8 kbps data rate. The transmission duty cycle on the reverse traffic channel will vary with the transmission data rate. Specifically, the transmission duty cycle for each rate is provided in Table I. As the duty cycle for transmission varies proportionately with the data rate, the actual burst transmission rate is fixed at 28,800 code symbols per second. Since six code symbols are modulated as one of 64 Walsh symbols for transmission, the Walsh symbol transmission rate shall be fixed at 4800 Walsh symbols per second which results in a fixed Walsh chip rate of 307.2 kcps.

All data that is transmitted on the reverse CDMA channel is convolutional encoded, block interleaved, modulated by 64-ary modulation, and direct-sequence PN spread prior to transmission. Table I further defines the relationships and rates for data and symbols for the various transmission rates on the reverse traffic channel. The numerology is identical for the access channel except that the transmission rate is fixed at 4.8 kbps, and the duty cycle is 100%. As described later herein each bit transmitted on the reverse CDMA channel is convolutional encoded using a rate 1/3 code. Therefore, the code symbol rate is always three times the data rate. The rate of the direct-sequence spreading functions shall be fixed at 1.2288 MHz, so that each Walsh chip is spread by precisely four PN chips.

TABLE I

Bit Rate (kbps)	9.6	4.8	2.4	1.2
PN Chip Rate (Mcps)	1.2288	1.2288	1.2288	1.2288
Code Rate (bits/code symbol)	1/3	1/3	1/3	1/3
TX Duty Cycle (%)	100.0	50.0	25.0	12.5
Code Symbol Rate (sps)	28,800	28,800	28,800	28,800
Modulation (code symbol/Walsh symbol)	6	6	6	6
Walsh Symbol Rate (sps)	4800	4800	4800	4800
Walsh Chip; Rate (kcps)	307.20	307.20	307.20	307.20
Walsh Symbol (μs)	208.33	208.33	208.33	208.33
PN Chips/Code Symbol	42.67	42.67	42.67	42.67
PN Chips/Walsh Symbol	256	256	256	256
PN Chips/Walsh Chip	4	4	4	4

Transmit portion 10, when functioning in mode in which primary traffic is present, communicates acoustical signals, such as speech and/or background noise, as digital signals over the transmission medium. To facilitate the digital communication of acoustical signals, these signals are sampled and digitized by well known techniques. For example, in Figure 1, sound is converted by microphone 12 to an analog signal which is then converted to a digital signal by codec 14. Codec 14 typically performs an analog to digital conversion process using a standard 8 bit/μlaw format. In the alternative, the analog signal may be directly converted to digital form in a uniform pulse code modulation (PCM) format. In an exemplary embodiment codec 14 uses an 8 kHz sampling and provides an output of 8 bit samples at the sampling rate so as to realize a 64 kbps data rate.

The 8-bit samples are output from codec 14 to vocoder 16 where a μlaw/uniform code conversion process is performed. In vocoder 16, the samples are organized into frames of input data wherein each frame is comprised of a predetermined number of samples. In a preferred implementation of vocoder 16 each frame is comprised of 160 samples or of 20 msec. of speech at the 8 kHz sampling rate. It should be understood that other sampling rates and frame sizes may be used. Each frame of speech samples is variable rate encoded by vocoder 16 with the resultant parameter data formatted into a corresponding data packet. The vocoder data packets are then output to microprocessor 18 and associated circuitry for transmission formatting. Microprocessor 18 generically includes program instructions contained with a program instruction memory, a data memory, and appropriate interface and related circuitry as is known in the art.

A preferred implementation of vocoder 16 utilizes a form of the Code Excited Linear Predictive (CELP) coding techniques so as to provide a variable rate in coded speech data. A Linear Predictive Coder (LPC) analysis is performed upon a constant number of samples, and the pitch and codebook searches are performed on varying numbers of samples depending upon the transmission rate. A variable rate vocoder of this type is described in further detail in WO 92/22891.

Vocoder 16 may be implemented in an application specific integrated circuit (ASIC) or in a digital signal processor.

In the variable rate vocoder just mentioned, the speech analysis frames are 20 msec. in length, implying that the extracted parameters are output to microprocessor 18 in a burst 50 times per second. Furthermore the rate of data output is varied from roughly 8 kbps to 4 kbps to 2 kbps, and to 1 kbps.

At full rate, also referred to as rate 1, data transmission between the vocoder and the microprocessor is at an 8.55 kbps rate. For the full rate data the parameters are encoded for each frame and represented by 160 bits. The full rate data frame also includes a parity check of 11 bits thus resulting in a full rate frame being comprised of a total of 171 bits. In the full rate data frame, the transmission rate between the vocoder and the microprocessor absent the parity check bits would be 8 kbps.

At half rate, also referred to as rate 1/2, data transmission between the vocoder and the microprocessor is at a 4 kbps rate with the parameters encoded for each frame using 80 bits. At quarter rate, also referred to as rate 1/4, data transmission between the vocoder and the microprocessor is at a 2 kbps rate with the parameters encoded for each frame using 40 bits. At eighth rate, also referred to as rate 1/8, data transmission between the vocoder and the microprocessor is slightly less than a 1 kbps rate with the parameters encoded for each frame using 16 bits.

In addition, no information may be sent in a frame between the vocoder and the microprocessor. This frame type, referred to as a blank frame, may be used for signaling or other non-vocoder data.

The vocoder data packets are then output to microprocessor 18 and CRC and Tail Bit generator 20 for completing the transmission formatting. Microprocessor 18 receives packets of parameter data every 20 msec. along with a rate indication for the rate the frame of speech samples was encoded. Microprocessor 18 also receives, if present, an input of secondary traffic data for output to generator 20. Microprocessor 18 also internally generates signaling data for output to generator 20. Data whether it is primary traffic, secondary traffic or signaling traffic matter, if present, is output from microprocessor 18 to generator 20 every 20 msec. frame.

Generator 20 generates and appends at the end of all full and half rate frames a set of parity check bits or cyclic redundancy check bits (CRC Bits) which are used at the receiver as a frame quality indicator. For a full rate frame, regardless of whether the data is a full rate primary, secondary or signaling traffic, or a combination of half rate primary and secondary traffic, or a combination of half rate primary and signaling traffic, generator 20 preferably generates a set of CRC Bits according to a first polynomial. For a half rate data frame, generator 20 also generates a set of CRC Bits preferably according to a second polynomial. Generator 20 further generates for all frame rates a set of Encoder Tail Bits which follow the CRC bits, if present, or data if CRC bits are not present, at the end of the frame. Further details of the operation on microprocessor 18 and generator 20 are provided later herein with reference to Figures 3 and 4.

Reverse traffic channel frames provided from generator 20 at the 9.6 kbps rate are 192 bits in length and span the 20 msec. frame. These frames consist of a single Mixed Mode Bit, auxiliary format bits if present, message bits, a 12-bit frame quality indicator (CRC), and 8 Encoder Tail Bits as shown in Figures 2a - 2e. The Mixed Mode Bit shall be set to '0' during any frame in which the message bits are primary traffic information only. When the Mixed Mode Bit is '0', the frame shall consist of the Mixed Mode Bit, 171 Primary Traffic bits, 12 CRC Bits, and 8 Encoder Tail Bits.

The Mixed Mode Bit is set to '1' for frames containing secondary or signaling traffic. In these instances the first bit following the Mixed Mode Bit is a Burst Format Bit which specifies whether the frame is in a "blank-and-burst" or a "dim-and-burst" format. A "blank-and-burst" operation is one in which the entire frame is used for secondary or signaling traffic while a "dim-and-burst" operation is one in which the primary traffic shares the frame with either secondary or signaling traffic. If the Burst Format Bit is a '0', the frame is of the "dim and burst format", and if a '1' the frame is of the "blank and burst format".

The second bit following the Mixed Mode Bit is a Traffic Type Bit. The Traffic Type Bit is used to specify whether the frame contains secondary or signaling traffic. If the Traffic Type Bit is a '0', the frame contains signaling traffic, and if a '1', the frame contains secondary traffic. Figures 2b - through 2e illustrate the Burst Format Bit and the Traffic Type Bit.

When the Burst Format Bit is '0' denoting dim-and-burst, the two bits following the Traffic Type Bit are Traffic Mode Bits. These bits indicate the number of bits that are used for primary traffic information and the number of bits that shall be used for either signaling or secondary traffic information within that frame. For a default mode, only the Traffic Mode '00' is defined with all other traffic modes reserved for other bit type and numbers. Referring to Figures 2b and 2c, in the exemplary and preferred embodiment, 80 bits are used for primary traffic (half rate vocoder data packet) while 86 and 87 bits are respectively used for signaling and secondary traffic.

In frames where there is signaling traffic present the first bit of the frame's signaling portion is a Start of Message (SOM) Bit. The SOM Bit is a '1' if a reverse traffic channel message (signaling message) begins at the following bit. Generally the first bit of a reverse traffic channel message does not begin anywhere else in the frame other than following the SOM Bit. However should the frame contain part of a message that began in a previous frame the SOM Bit is a '0'. If the SOM Bit is a '0' the following bit is part of the message but it is not the first bit of the complete message.

In the preferred implementation only primary traffic is transmitted in frames at the 4.8 kbps, 2.4 kbps, and 1.2 kbps rates. Mixed mode operation is generally not be supported at rates other than the 9.6 kbps rate, although it may be readily configured to do so. The frame formats for these particular rates are shown in Figures 2f - 2h. For the 4.8 kbps rate, the frame is 96 bits in length with the bits spaced over the 20 msec. time period of the frame as described later herein. The 4.8 kbps rate frame contains 80 primary traffic bits, an 8-bit frame quality indicator (CRC), and 8 Encoder Tail Bits. For the 2.4 kbps rate, the frame is 48 bits in length with the bits spaced over the 20 msec. time period of the frame as also described later herein. The 2.4 kbps rate frame contains 40 primary traffic bits and 8 Encoder Tail Bits. For the 1.2 kbps rate, the frame is 24 bits in length with the bits spaced over the 20 msec. time period of the frame as also described later herein. The 1.2 kbps rate frame contains 16 primary traffic bits and 8 encoder tail bits.

In a preferred embodiment the access channel data is generated by microprocessor 18 for transmission at a rate of 4.8 kbps. As such the data is prepared in a manner identical to that of 4.8 kbps frame format data, such as encoding, interleaving as Walsh encoding. In the encoding scheme implemented for the 4.8 kbps data, whether reverse traffic channel data or access channel data, redundant data is generated. Unlike the reverse traffic channel where the redundant data is eliminated in the transmission, in the access channel all data including redundant data is transmitted. Details on the transmission aspects of frames of access channel data are provided later herein.

Figure 3 illustrates an exemplary implementation of the elements for formatting the data in accordance with Figures 2a - 2h. In Figure 3 data is transmitted from microprocessor 18 (Figure 1) to generator 20. Generator 20 is comprised of data buffer and control logic 60, CRC circuits 62 and 64, and Tail Bit circuit 66. Along with data provided from the

microprocessor a rate command may optionally be provided. Data is transferred for each 20 msec frame from the microprocessor to logic 60 where temporarily stored. For each frame, logic 60 may for each frame count the number of bits transmitted from the microprocessor, or in the alternative use the rate command and a count of the clock cycles in formatting a frame of data.

Each frame of the traffic channel includes a frame quality indicator. For the 9.6 kbps and 4.8 kbps transmission rates, the frame quality indicator is the CRC. For the 2.4 kbps and 1.2 kbps transmission rates, the frame quality indicator is implied, in that no extra frame quality bits are transmitted. The frame quality indicator supports two functions at the receiver. The first function is to determine the transmission rate of the frame, while the second function is to determine whether the frame is in error. At the receiver these determinations are made by a combination of the decoder information and the CRC checks.

For the 9.6 kbps and 4.8 kbps rates, the frame quality indicator (CRC) is calculated on all bits within the frame, except the frame quality indicator (CRC) itself and the Encoder Tail Bits. Logic 60 provides the 9.6 kbps and 4.8 kbps rate data respectively to CRC circuits 62 and 64. Circuits 62 and 64 are typically constructed as a sequence of shift registers, modulo-2 adders (typically exclusive-OR gates) and switches as illustrated.

The 9.6 kbps transmission rate data uses a 12-bit frame quality indicator (CRC), which is be transmitted within the 192-bit long frame as discussed with reference to Figures 2a - 2e. As illustrated in Figure 3 for CRC circuit 62, the generator polynomial for the 9.6 kbps rate is as follows:

$$g(x) = x^{12} + x^{11} + x^{10} + x^9 + x^8 + x^4 + x + 1. \quad (1)$$

The 4.8 kbps transmission rate data uses an 8-bit CRC, which is transmitted within the 96-bit long frame as discussed with reference to Figure 2f. As illustrated in Figure 3 for CRC circuit 64, the generator polynomial for the 4.8 kbps rate is as follows:

$$g(x) = x^8 + x^7 + x^4 + x^3 + x + 1. \quad (2)$$

Initially, all shift register elements of circuits 62 and 64 are set to logical one ('1') by an initialization signal from logic 60. Furthermore logic 60 set the switches of circuits 62 and 64 in the up position.

For 9.6 kbps rate data, the registers of circuit 62 are then clocked 172 times for the 172 bits in the sequence of primary traffic, secondary traffic or signaling bits or a mixture thereof along with the corresponding mode/format indicator bits as input to circuit 62. After 172 bits are clocked through circuit 62, logic 60 then sets the switches of circuit 62 in the down position with the registers of circuit 62 then being clocked an additional 12 times. As a result of the 12 additional clockings of circuit 62, 12 additional output bits are generated which are the CRC bits. The CRC bits, in the order calculated, are appended to the end of the 172 bits as output from circuit 62. It should be noted that the 172 bits output from logic 60 which pass through circuit 62 are undisturbed by the computation of the CRC bits and are thus output from circuit 62 in the same order and at the same value at which they entered.

For 9.6 kbps rate data bits are input to circuit 64 from logic 60 in the following order. For the case of primary traffic only, the bits are input to circuit 64 from logic 60 in the order of the single mixed mode (MM) bit followed by the 171 primary traffic bits. For the case of "dim and burst" with primary and signaling traffic, the bits are input to circuit 64 from logic 60 in the order of the single MM bit, a single burst format (BF) bit, a traffic type ($\overline{TT}$) bit, a pair of traffic mode (TM) bits, 80 primary traffic bits, a start of message (SOM) bit, and 86 signaling traffic bits. For the case of "dim and burst" with primary and secondary traffic, the bits are input to circuit 64 from logic 60 in the order of the single MM bit, the single BF bit, the TT bit, the pair of TM bits, 80 primary traffic bits and 87 signaling traffic bits. For the case of "blank and burst" data format with signaling traffic only, the bits are input to circuit 64 from logic 60 in the order of the single MM bit, the single BF bit, the TT bit, the SOM bit and 168 signaling traffic bits. For the case of "blank and burst" data format with secondary traffic only, the bits are input to circuit 64 from logic 60 in the order of the single MM bit, the single BF bit, the TT bit and 169 signaling traffic bits.

Similarly for 4.8 kbps rate data, the registers of circuit 64 are clocked 80 times for the 80 bits of primary traffic data, or for the 80 bits of access channel data, as input to circuit 64 from logic 60. After the 80 bits are clocked through circuit 64, logic 60 then sets the switches of circuit 64 in the down position with the registers of circuit 64 then being clocked an additional 8 times. As a result of the 12 additional clockings of circuit 62, 12 additional output bits are generated which are the CRC bits. The CRC bits, in the order calculated, are again appended to the end of the 80 bits as output from circuit 64. It should again be noted that the 80 bits output from logic 60 which pass through circuit 64 are undisturbed by the computation of the CRC bits and are thus output from circuit 64 in the same order and at the same value at which they entered.

The bits output from either of circuits 62 and 64 are provided to switch 66 which is under the control of logic 60. Also input to switch 66 are the 40 and 16 bits of primary traffic data output from logic 60 for 2.4 kbps and 1.2 kbps data frames. Switch 66 selects between providing an output of the input data (up position) and tail bits at a logical zero ('0') value (down position). Switch 66 is normally set in the up position to permit data from logic 60, and from circuits 62 and

64 if present, to be output from generator 20 to encoder 22 (Figure 1). For the 9.6 kbps and 4.8 kbps frame data, after the CRC bits are docked through switch 66, logic 60 sets the switch to the down position for 8 clock cycles so as to generate 8 all zero tail bits. Thus for 9.6 kbps and 4.8 kbps data frames, the data as output to the encoder for the frame includes appended after the CRC bits, the 8 tail bits. Similarly for the 2.4 kbps and 1.2 kbps frame data, after the primary traffic bits are clocked from logic 60 through switch 66, logic 60 sets the switch to the down position for 8 clock cycles so as to again generate 8 all zero tail bits. Thus for 2.4 kbps and 1.2 kbps data frames, the data as output to the encoder for the frame includes appended after the primary traffic bits, the 8 tail bits.

Figures 4a - 4e illustrate in a series of flow charts the operation of microprocessor 18, and generator 20 in assembling the data into the disclosed frame format. It should be noted that various schemes may be implemented for giving the various traffic types and rates priority for transmission. In an exemplary implementation, when a signaling traffic message is to be sent when there is vocoder data present a "dim and burst" format may be selected. Microprocessor 18 may generate a command to vocoder 18 for the vocoder to encode speech sample frames at the half rate, regardless of the rate at which the vocoder would normally encode the sample frame. Microprocessor 18 then assembles the half rate vocoder data with the signaling traffic into the 9.6 kbps frame as illustrated in Figure 2b. In this case, a limit may be place on the number of speech frames encoded at the half rate to avoid degradation in the speech quality. In the alternative, microprocessor 18 may wait until a half rate frame of vocoder data is received before assembling the data into the "dim and burst" format. In this case, in order to ensure timely transmission of the signaling data, a maximum limit on the number of consecutive frames at other than half rate may be imposed before a command is sent to the vocoder to encode at half rate. Secondary traffic may be transferred in the "dim and burst" format (Figure 2c) in a similar manner.

Similar is the case for the "blank and burst" data formats as illustrated in Figures 2d - 2d. The vocoder may be commanded to not encode the frame of speech samples or the vocoder data is ignored by the microprocessor in constructing the data frame. Prioritizing between generating frame formats of primary traffic of various rate, "dim and burst" traffic, and "blank and burst" traffic is open to many possibilities.

Referring back to Figure 1, 20 msec. frames of 9.6 kbps, 4.8 kbps, 2.4 kbps and 1.2 kbps data are thus output from generator 20 to encoder 22. In the exemplary embodiment encoder 22 is a preferably a convolutional encoder, a type of encoder well known in the art. Encoder 22 preferably encodes the data using a rate 1/3 , constraint length k = 9 convolutional code. As an example encoder 22 is constructed with generator functions of g_0 = 557(octal), g_1 = 663(octal) and g_2 = 711(octal). As is well known in the art, convolutional encoding involves the modulo-2 addition of selected taps of a serially time-shifted delayed data sequence. The length of the data sequence delay is equal to k-1, where k is the code constraint length. Since in the preferred embodiment a rate 1/3 code is used, three code symbols, the code symbols (c_0), (c_1) and (c_2), are generated for each data bit input to the encoder. The code symbols (c_0), (c_1) and (c_2) are respectively generated by the generator functions g_0, g_1 and g_2. The code symbols are output from encoder 22 to block interleaver 24. The output code symbols are provided to interleaver 24 in the order of the code symbol (c_0) being first, the code symbol (c_1) being second and the code symbol (c_2) being last. The state of the encoder 22, upon initialization, is the all-zero state. Furthermore the use of tail bits at the end of each frame provides a resetting of encoder 22 to an all-zero state.

The symbols output from encoder 22 are provided to block interleaver 24 which under the control of microprocessor 18 provides a code symbol repetition. Using a conventional random access memory (RAM) with the symbols stored therein as addressed by microprocessor 18, code symbols may be stored in a manner to achieve a code symbol repetition rate that varies with the data channel.

Code symbols are not be repeated for the 9.6 kbps data rate. Each code symbol at the 4.8 kbps data rate is repeated 1 time, i.e. each symbol occurs 2 times. Each code symbol at the 2.4 kbps data rate is repeated 3 times, i.e. each symbol occurs 4 times. Each code symbol at the 1.2 kbps data rate is repeated 7 times, i.e. each symbol occurs 8 times. For all data rates (9.6, 4.8, 2.4 and 1.2 kbps), the code repetition results in a constant code symbol rate of 28,800 code symbols per second for the data as output from interleaver 24. On the reverse traffic channel the repeated code symbols are not transmitted multiple times with all but one of the code symbol repetitions deleted prior to actual transmission due to the variable transmission duty cycle as discussed in further detail below. It should be understood that the use of code symbol repetition as an expedient method for describing the operation of the interleaver and a data burst randomizer as discussed again in further detail below. It should be further understood that implementations other than those that use code symbol repetition may be readily devised that achieve the same result and remain within the teaching of the present invention.

All code symbols to be transmitted on the reverse traffic channel and the access channel are interleaved prior to modulation and transmission. Block interleaver 24, constructed as is well known in the art, provides an output of the code symbols over a time period spanning 20 msec. The interleaver structure is typically a rectangular array with 32 rows and 18 columns, i.e. 576 cells. Code symbols are written into the interleaver by columns, with repetition for data at the 9.6, 4.8, 2.4 and 1.2 kbps rate, so as to completely fill the 32 x 18 matrix. Figures 5a - 5d illustrate the ordering of write operations of repeated code symbols into the interleaver array for transmission data rates of 9.6, 4.8, 2.4 and 1.2 kbps, respectively.

Reverse traffic channel code symbols are output from the interleaver by rows. Microprocessor 18 also controls the addressing of the interleaver memory for outputting the symbols in the appropriate order. The interleaver rows are preferably output in the following order:

At 9.6 kbps:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

At 4.8 kbps:

1 3 2 4 5 7 6 8 9 11 10 12 13 15 14 16 17 19 18 20 21 23 22 24 25 27 26 28 29 31 30 32

At 2.4 kbps:

1 5 2 6 3 7 4 8 9 13 10 14 11 15 12 16 17 21 18 22 19 23 20 24 25 29 26 30 27 31 28 32

At 1.2 kbps:

1 9 2 10 3 11 4 12 5 13 6 14 7 15 8 16 17 25 18 26 19 27 20 28 21 29 22 30 23 31 24 32.

Access channel code symbols are also output from interleaver 24 by rows. Microprocessor 18 again controls the addressing of the interleaver memory for outputting the symbols in the appropriate order. The interleaver rows are output in the following order at the 4.8 kbps rate for the access channel code symbols:
1 17 9 25 5 21 13 29 3 19 11 27 7 23 15 31 2 18 10 26 6 22 14 30 4 20 12 28 8 24 16 32.

It should be noted that other encoding rates, such as a rate 1/2 convolutional code used on the forward transmission channel, along with various other symbol interleaving formats may be readily devised using the basic teaching of the present invention

Referring again to Figure 1, the interleaved code symbols are output from interleaver 24 to modulator 26. In the preferred embodiment modulation for the Reverse CDMA Channel uses 64-ary orthogonal signaling. That is, one of 64 possible modulation symbols is transmitted for each six code symbols. The 64-ary modulation symbol is one of 64 orthogonal waveforms generated preferably using Walsh functions. These modulation symbols are given in Figures 6a - 6c and are numbered 0 through 63 The modulation symbols are selected according to the following formula:

$$\text{Modulation symbol number} = c_0 + 2_{c1} + 4_{c2} + 8_{c3} + 16_{c4} + 32_{c5} \quad (3)$$

where c_5 shall represent the last or most recent and c_0 the first or oldest binary valued ('0' and '1') code symbol of each group of six code symbols that form a modulation symbol. The period of time required to transmit a single modulation symbol is referred to as a "Walsh symbol" interval and is approximately equal to 208.333 µs. The period of time associated with one-sixty-fourth of the modulation symbol is referred to as a "Walsh chip" and is approximately equal to 3.2552083333... µs.

Each modulation or Walsh symbol is output from modulator 26 to one input of a modulo-2 adder, exclusive-OR gate 28. The Walsh symbols are output from modulator at a 4800 sps rate which corresponds to a Walsh chip rate of 307.2 kcps. The other input to gate 28 is provided from long code generator 30 which generates a masked pseudonoise (PN) code, referred to as the long code sequence, in cooperation with mask circuit 32. The long code sequence provided from generator 30 is at a chip rate rate four times the Walsh chip rate of modulator 26, i.e. a PN chip rate 1.2288 Mcps. Gate 28 combines the two input signals to provide an output of data at the chip rate of 1.2288 Mcps.

The long code sequence is a time shift of a sequence of length 2^{42}-1 chips and is generated by a linear generator well known in the art using the following polynomial:

$$p(x) = x^{42} + x^{35} + x^{33} + x^{31} + x^{27} + x^{26} + x^{25} + x^{22} + x^{21} + x^{19} + x^{18} + x^{17} + x^{16} + x^{10} + x^{7} + x^{6} + x^{5} + x^{3} + x^{2} + x^{1} + 1 \quad (4)$$

Figure 7 illustrates generator 30 in further detail. Generator 30 is comprised of a sequence generator section 70 and a masking section 72. Section 70 is comprised of a sequence of shift registers and modulo-2 adders (typically exclusive-OR gates) coupled together to generate a 42-bit code according to equation 4. The long code is then generated by masking the 42-bit state variables output from section 70 with a 42-bit wide mask provided from mask circuit 32.

Section 72 is comprised of a series of input AND gates 74_1 - 74_{42} having one input for receiving a respective mask bit of the 42-bit wide mask. The other input of each of AND gates 74_1 - 74_{42} receives the output from a corresponding

shift register in section 70. The output of AND gates 74_1 - 74_{42} are modulo-2 added by adder 76 to form a single bit output for each 1.2288 MHz clocking of the shift registers of section 70. Adder 76 is typically constructed as a cascaded arrangement of exclusive-OR gates as is well known in the art. Therefore, the actual output PN sequence is generated by the modulo-2 addition of all 42 masked output bits of sequence generator 70 as shown in Figure 7.

The mask used for the PN spreading shall vary depending on the channel type on which the mobile station is communicating. Referring to Figure 1, an intialization information is provided from microprocessor 18 to generator 30 and circuit 32. Generator 30 is responsive to the initialization information for initialization of the circuitry. Mask 32 is also responsive to the initialization information, which indicates the mask type to be provided, to output a 42-bit mask. As such, mask circuit 32 may be configured as a memory which contains a mask for each communication channel type. Figures 8a - 8c provide an exemplary definition of the masking bits for each channel type.

Specifically, when communicating on the Access Channel, the mask is defined as illustrated in Figure 8a. In the Access Channel mask, mask bits M_{24} through M_{41} are set to '1'; mask bits M_{19} through M_{23} are set to the chosen Access Channel number; mask bits M_{16} through M_{18} are set to the code channel for the associated Paging Channel, i.e, the range typically being 1 through 7; mask bits M_9 through M_{15} are set to the registration zone; for the current base station; and mask bits M_0 through M_8 are set to the pilot PN value for the current CDMA Channel.

When communicating on the Reverse Traffic Channel, the mask is defined as illustrated in Figure 8b. The mobile station uses one of two long codes unique to that mobile station: a public long code unique to the mobile station's electronic serial number (ESN); and a private long code unique for each mobile identification number (MIN) which is typically the telephone number of the mobile station. In the public long code the mask bits M_{32} through M_{41} are set to '0,' and the mask bits M_0 through M_{31} are set to the mobile station ESN value.

It is further envisioned that a private long code may be implemented as illustrated in Figure 8c. The private long code will provide additional security in that it will only be known to the base station and the mobile station. The private long code will not be transmitted in the clear over the transmission medium. In the private long code the mask bit M_{40} through M_{41} are set to '0' and '1' respectively; while mask bits M_0 through M_{39} may be set to according to a predetermined assignment scheme.

Referring back to Figure 1 the output of gate 28 is respectively provided as one input to each one of a pair of modulo-2 adders, exclusive-OR gates 34 and 36. The other input to each of gates 34 and 36 are second and third PN sequences are I and Q channel "short codes" respectively generated by I and Q Channel PN generators 38 and 40. The Reverse Access Channel and Reverse Traffic Channel is therefore OQPSK spread prior to actual transmission. This offset quadrature spreading on the Reverse Channel uses the same I and Q PN codes as the Forward Channel I and Q pilot PN codes. The I and Q PN codes generated by generators 38 and 40 are of length 2^{15} and are preferably the zero-time offset codes with respect to the Forward Channel. For purposes of further understanding, on the Forward Channel a pilot signal is generated for each base station. Each base station pilot channel signal is spread by the I and Q PN codes as just mentioned. Base station I and Q PN codes are offset from one another, by a shifting of the code sequence, so as to provide distinction between base station transmission. The generating functions for the I and Q short PN codes shall be as follows:

$$P_I(x) = x^{15} + x^{13} + x^9 + x^8 + x^7 + x^5 + 1 \quad (5)$$

and

$$P_Q(x) = x^{15} + x^{12} + x^{11} + x^{10} + x^6 + x^5 + x^4 + x^3 + 1. \quad (6)$$

Generators 38 and 40 may be constructed as is well known in the art so as to provide an output sequence in accordance with equations (5) and (6).

The I and Q waveforms are respectively output from gates 34 and 36 where respectively provided as inputs to finite impulse response (FIR) filters 42 and 44. FIR filters 42 and 44 are digital filters which bandlimit the resulting I and Q waveforms. These digital filters shape the I and Q waveforms such that the resulting spectrum is contained within a given spectral mask. The digital filters preferably have the impulse response shown in the following Table II:

TABLE II

h(0) =	-0.02204953170628	= h(46)	h(12) =	0.03881898337058	= h(34)
h(1) =	-0.01997721494122	= h(45)	h(13) =	0.10411392223653	= h(33)
h(2) =	-0.00905191683798	= h(44)	h(14) =	0.11268193747141	= h(32)
h(3) =	0.02005789896688	= h(43)	h(15) =	0.04184165339577	= h(31)
h(4) =	0.05926358628876	= h(42)	h(16) =	-0.08271278252498	= h(30)
h(5) =	0.09021366056377	= h(41)	h(17) =	-0.18998156787345	= h(29)
h(6) =	0.09304356333555	= h(40)	h(18) =	-0.19486048259840	= h(28)
h(7) =	0.05917668051274	= h(39)	h(19) =	-0.04343248005925	= h(27)
h(8) =	0.00032251394639	= h(38)	h(20) =	0.25121616493295	= h(26)
h(9) =	-0.05381152911745	= h(37)	h(21) =	0.60403450701992	= h(25)
h(10) =	-0.07036222587323	= h(36)	h(22) =	0.89017616954958	= h(24)
h(11) =	-0.03405975708422	= h(35)	h(23) =	1	= h(23)

Filters 42 and 44 may be constructed according to well known digital filter techniques and preferably provide a frequency response as illustrated in Figure 9.

The binary '0' and '1' inputs to digital filters 42 and 44, generated by the PN spreading functions, are mapped into +1 and -1, respectively. The sampling frequency of the digital filter is 4.9152 MHz = 4 x 1.2288 MHz. An additional binary '0' and '1' input sequence synchronous with the I and Q digital waveforms shall be provided to each of digital filters 42 and 44. This particular sequence, referred to as a masking sequence, is the output generated by a data burst randomizer. The masking sequence multiplies the I and Q binary waveforms to produce a ternary (-1, 0, and +1) input to the digital filters 42 and 44.

As discussed previously the data rate for transmission on the Reverse Traffic Channel is at one of the rates of equal 9.6, 4.8, 2.4, or 1.2 kbps and varies on a frame-by-frame basis. Since the frames are of a fixed 20 ms length for both the Access Channel and the Reverse Traffic Channel, the number of information bits per frame shall be 192, 96, 48, or 24 for transmission at data rates of 9.6, 4.8, 2.4, or 1.2 kbps, respectively. As described previously, the information is encoded using a rate 1/3 convolutional encoder and then the code symbols shall be repeated by a factor of 1, 2, 4, or 8 for a data rate of 9.6, 4.8, 2.4, or 1.2 kbps, respectively. The resulting repetition code symbol rate is thus fixed at 28,800 symbols per second (sps). This 28,800 sps stream is block interleaved as previously described.

Prior to transmission, the Reverse Traffic Channel interleaver output stream is gated with a time filter that allows transmission of certain interleaver output symbols and deletion of others. The duty cycle of the transmission gate thus varies with the transmit data rate. When the transmit data rate is 9.6 kbps, the transmission gate allows all interleaver output symbols to be transmitted. When the transmit data rate is 4.8 kbps, the transmission gate allows one-half of the interleaver output symbols to be transmitted, and so forth. The gating process operates by dividing the 20 msec frame into 16 equal length (i.e., 1.25 ms) periods, called power control groups. Certain power control groups are gated on (i.e., transmitted), while other groups are gated off (i.e., not transmitted).

The assignment of gated-on and gated-off groups is referred to as a data burst randomizer function. The gated-on power control groups are pseudo-randomized in their positions within the frame so that the actual traffic load on the Reverse CDMA Channel is averaged, assuming a random distribution of the frames for each duty cycle. The gated-on power control groups are such that every code symbol input to the repetition process shall be transmitted once without repetition. During the gated-off periods, the mobile station does not transmit energy, thus reducing the interference to other mobile stations operating on the same Reverse CDMA Channel. This symbol gating occurs prior to transmission filtering.

The transmission gating process is not used when the mobile station transmits on the Access Channel. When transmitting on the Access Channel, the code symbols are repeated once (each symbol occurs twice) prior to transmission.

In the implementation of the data burst randomizer function, data burst randomizer logic 46 generates a masking stream of 0's and 1's that randomly mask out the redundant data generated by the code repetition. The masking stream pattern is determined by the frame data rate and by a block of 14 bits taken from the long code sequence generated by generator 30. These mask bits are synchronized with the data flow and the data is selectively masked by these bits through the operation of the digital filters 42 and 44. Within logic 46 the 1.2288 MHz long code sequence output from

generator 30 is input to a 14-bit shift register, which is shifted at a 1.2288 MHz rate. The contents of this shift register are loaded into a 14-bit latch exactly one power control group (1.25 ms) before each Reverse Traffic Channel frame boundary. Logic 46 uses this data along with the rate input from microprocessor 18, to determine, according to a predetermined algorithm, the particular power control group(s) in which the data is to be allowed to pass through filters 42 and 46 for transmission. Logic 46 thus outputs for each power control group a '1' or '0' for the entire power control group depending on whether the data is to be filtered out ('0') or passed through ('1'). At the corresponding receiver, which also uses the same long code sequence and a corresponding rate determined for the frame, determines the appropriate power control group(s) in which the data is present.

The I channel data output from filter 42 is provided directly to a digital to analog (D/A) converter and anti-aliasing filter circuit 50. The Q channel data however is output from filter 44 to a delay element 48 which a one-half PN chip time delay (406.9 nsec) in the Q channel data. The Q channel data is output from delay element 48 to digital to analog (D/A) converter and anti-aliasing filter circuit 52. Circuits 50 and 52 convert the digital data to analog form and filter the analog signal. The signals output from circuits 50 and 52 are provided to Offset Quadrature Phase Shift Key (OQPSK) modulator 54 where modulated and output to RF transmitter circuit 56. Circuit 56 amplifies, filters and frequency upconverts the signal for transmission. The signal is output from circuitry 56 to antenna 58 for communication to the base station via transmitter 100.

It should be understood that the exemplary embodiment of the present invention discusses the formatting of data for modulation and transission with respect to a mobile station. It should be understood that the data formatting is the same for a cell base station, however the modulation may be different.

Claims

1. A communication system in which transmission takes place according to a format which permits different types of data to be combined and transmitted within a single transmission, characterized in that the communication system transmits variable length frames of data in packets, and in that a data combining and transmission sub-system (14, 16, 18, 20) is provided so that when a frame of data of said variable length frames of data does not require a complete packet for transmission, the data combining sub-system combines said frame of data with additional data to provide a complete packet, said data combining sub-system comprising input means for receiving said frame of data and additional data and for combining said frame of data and said additional data to provide said complete packet responsive to a control signal, and control means for providing said control signal.

2. A communication system according to Claim 1 wherein said control means (18) is responsive to a data rate signal.

3. A communication system according to Claim 1 wherein said frame of data comprises speech data and said additional data comprises signalling data.

4. A communication system according to Claim 1 wherein said frame of data comprises speech data and said additional data comprises secondary traffic data.

5. A communication system according to any one of Claims 1 to 4 wherein said transmission packet further comprises at least one overhead bit (TT) indicative of a type of said additional data.

6. A communication system according to any of Claims 1 to 5 which is a digital communication system.

7. A communication system according to any of Claims 1 to 5 which is a spread spectrum communications system.

8. A communication system according to any of the preceding claims in which the input means and control means of said sub-system comprise:

variable rate vocoder means (16) for receiving samples of speech data, encoding said speech samples to provide coded speech data at a data rate of a plurality of data rates;

processor means (18) for receiving said coded speech data and additional data, and when said speech data is provided at a rate less than a predetermined maximum, combining said coded speech data with said additional data to provide a packet of data.

9. A method for use in a communication system for transmitting data of a first type and data of a second type in packets having a data capacity including the steps of receiving said data of said first type and said data of said second type characterized in that when said data of said first type does not use all of said data capacity in a data packet, the excess capacity in said data packet is used by combining data of said second type with said data of said first type to provide said packet.

10. The method of Claim 9 wherein said data of said first type comprises coded speech data and said data of said second type comprises signaling data.

11. The method of Claim 10 wherein said data of said first type comprises coded speech data and said data of said second type comprises secondary traffic data.

12. The method of any of Claims 9 to 11 when used in a digital communication system.

13. The method of any of Claims 9 to 11 when used in a spread spectrum communications system, the combined data being transmitted in accordance with a spread spectrum modulation format.

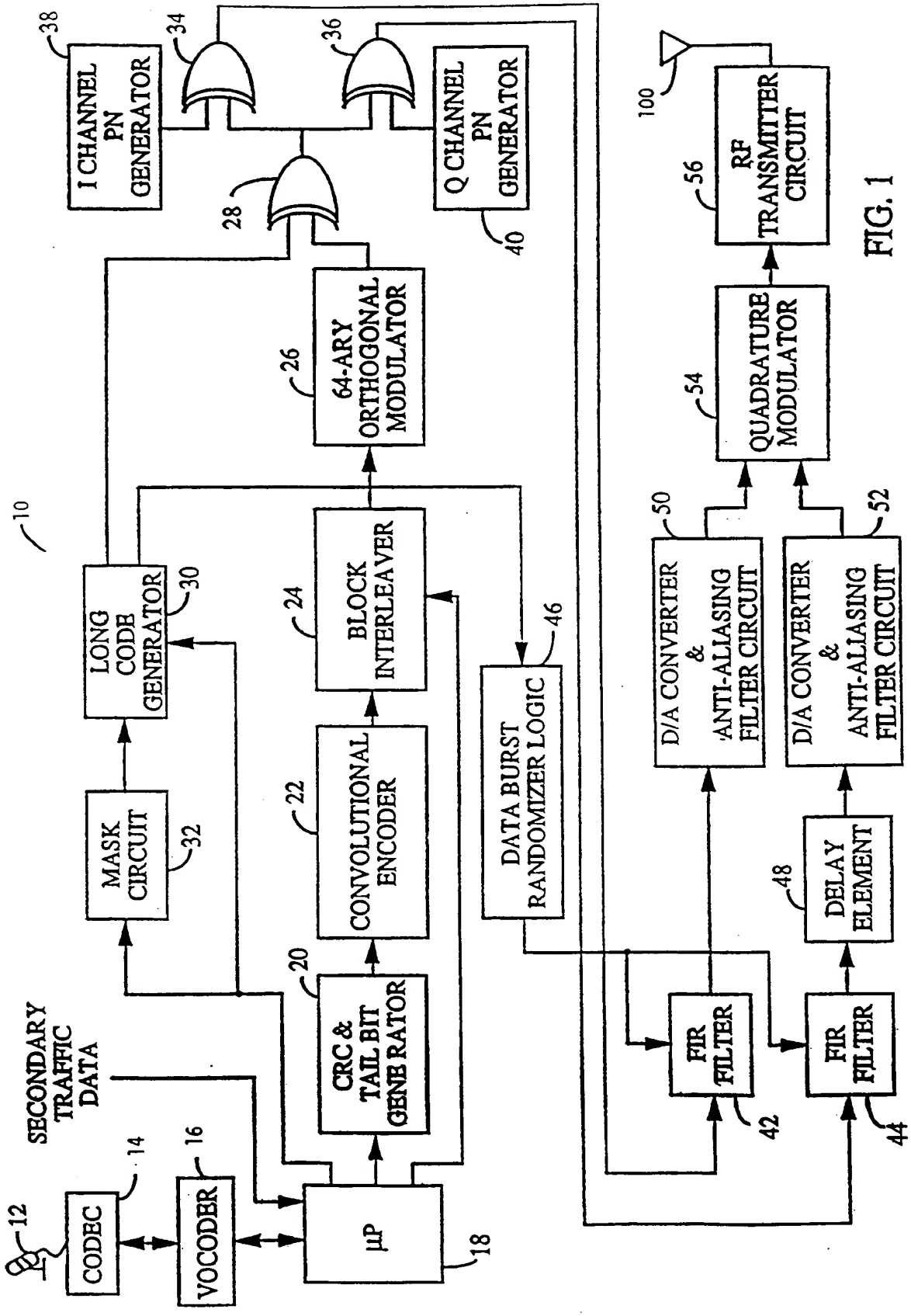


FIG. 1

FIG. 2a
PRIMARY TRAFFIC ONLY (9.6 KBPS)

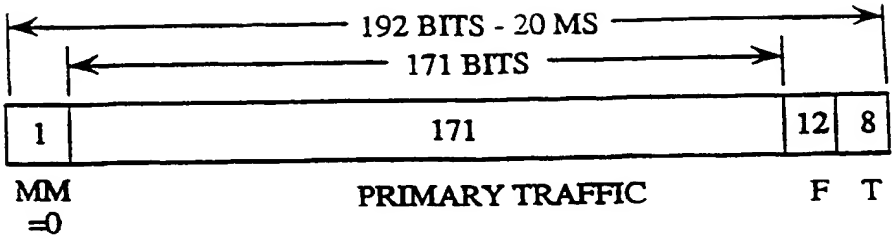


FIG. 2b
DIM AND BURST WITH PRIMARY AND SIGNALING TRAFFIC (9.6 KBPS)

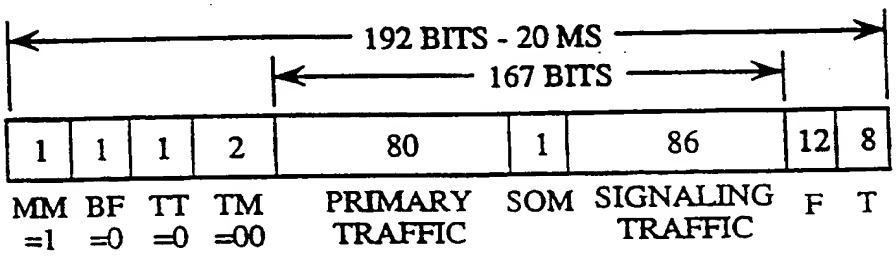


FIG. 2c
DIM AND BURST WITH PRIMARY AND SECONDARY TRAFFIC (9.6 KBPS)

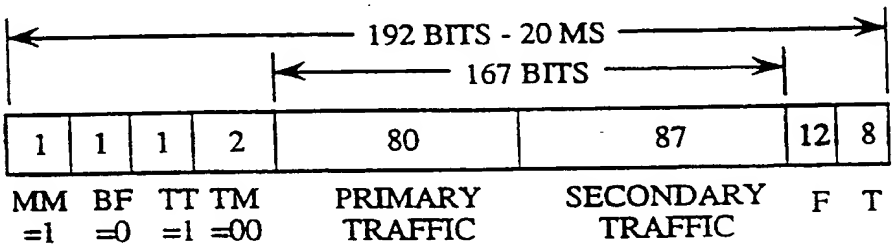


FIG. 2d
BLANK AND BURST WITH SIGNALING TRAFFIC ONLY (9.6 KBPS)

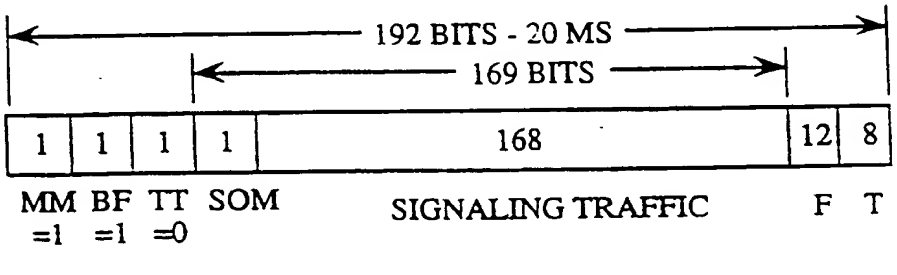


FIG. 2e
BLANK AND BURST WITH SECONDARY TRAFFIC ONLY (9.6 KBPS)

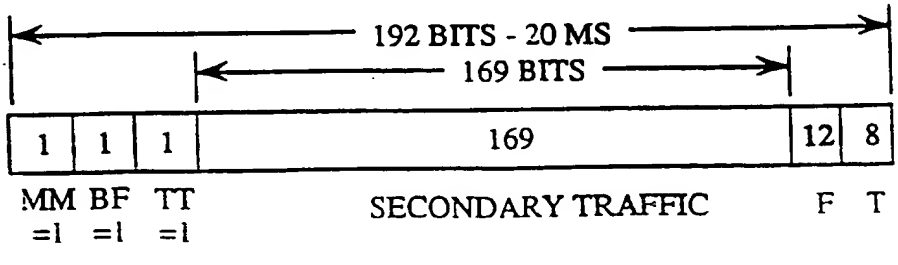


FIG. 2f
4.8 KBPS FRAME FORMAT

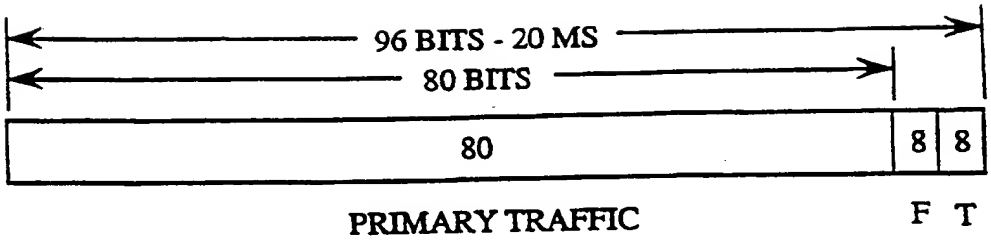


FIG. 2g
2.4 KBPS FRAME FORMAT

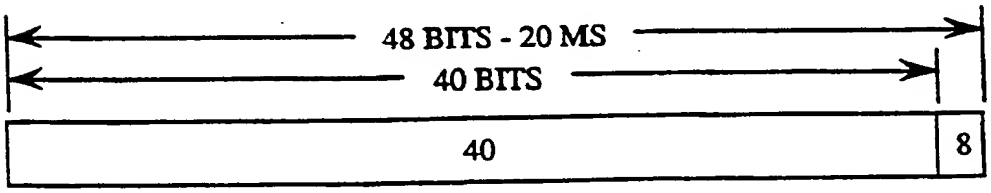


FIG. 2h
1.2 KBPS FRAME FORMAT

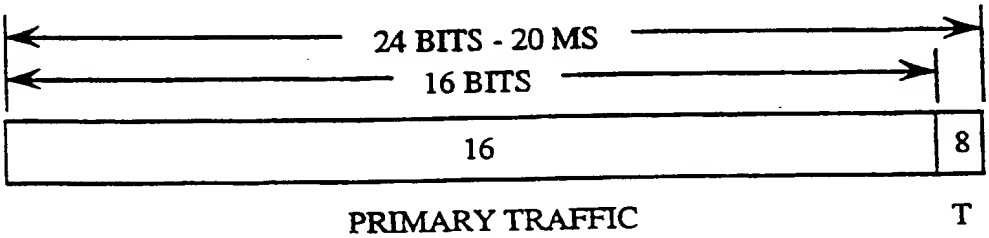


FIG. 3

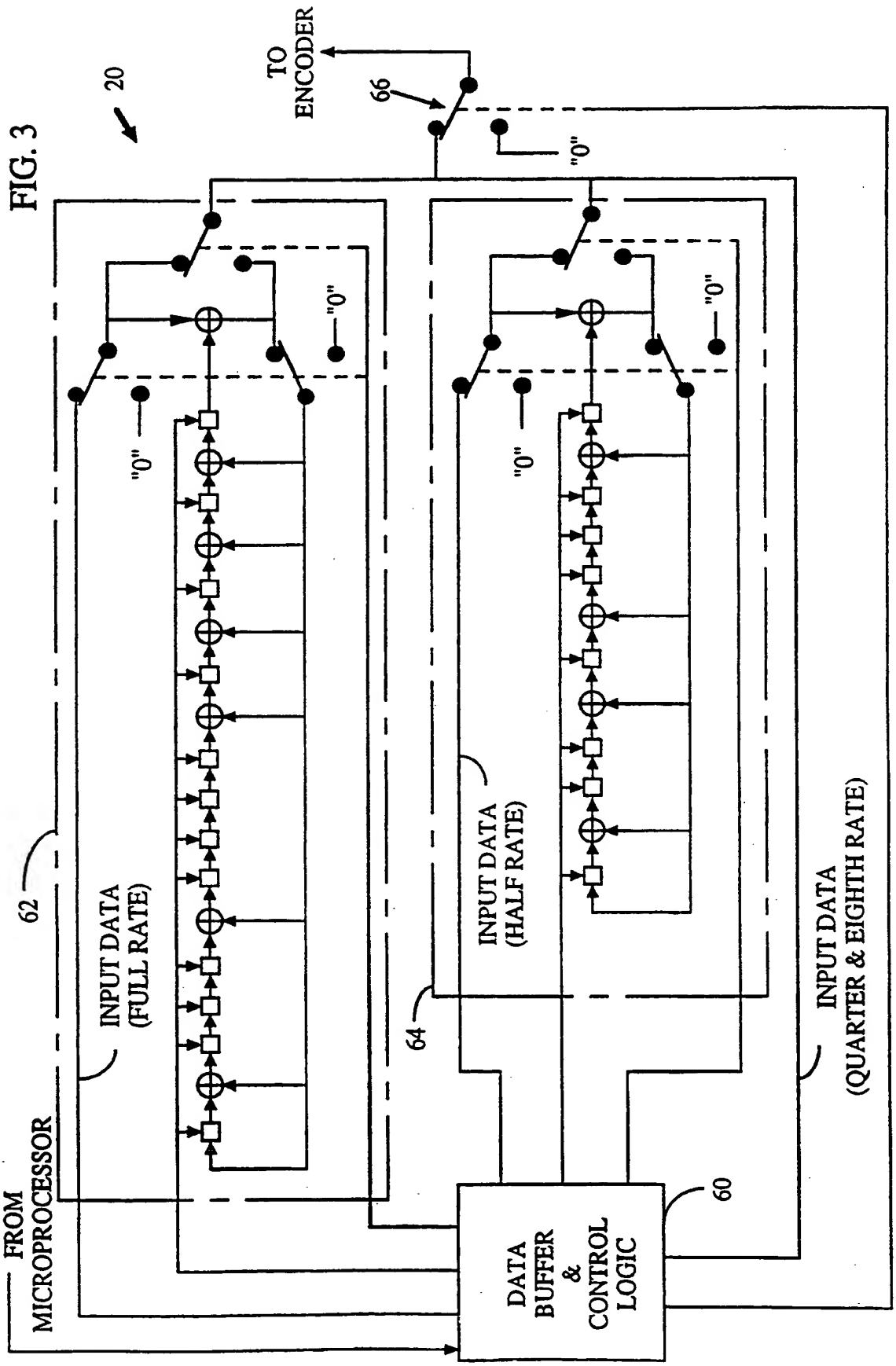
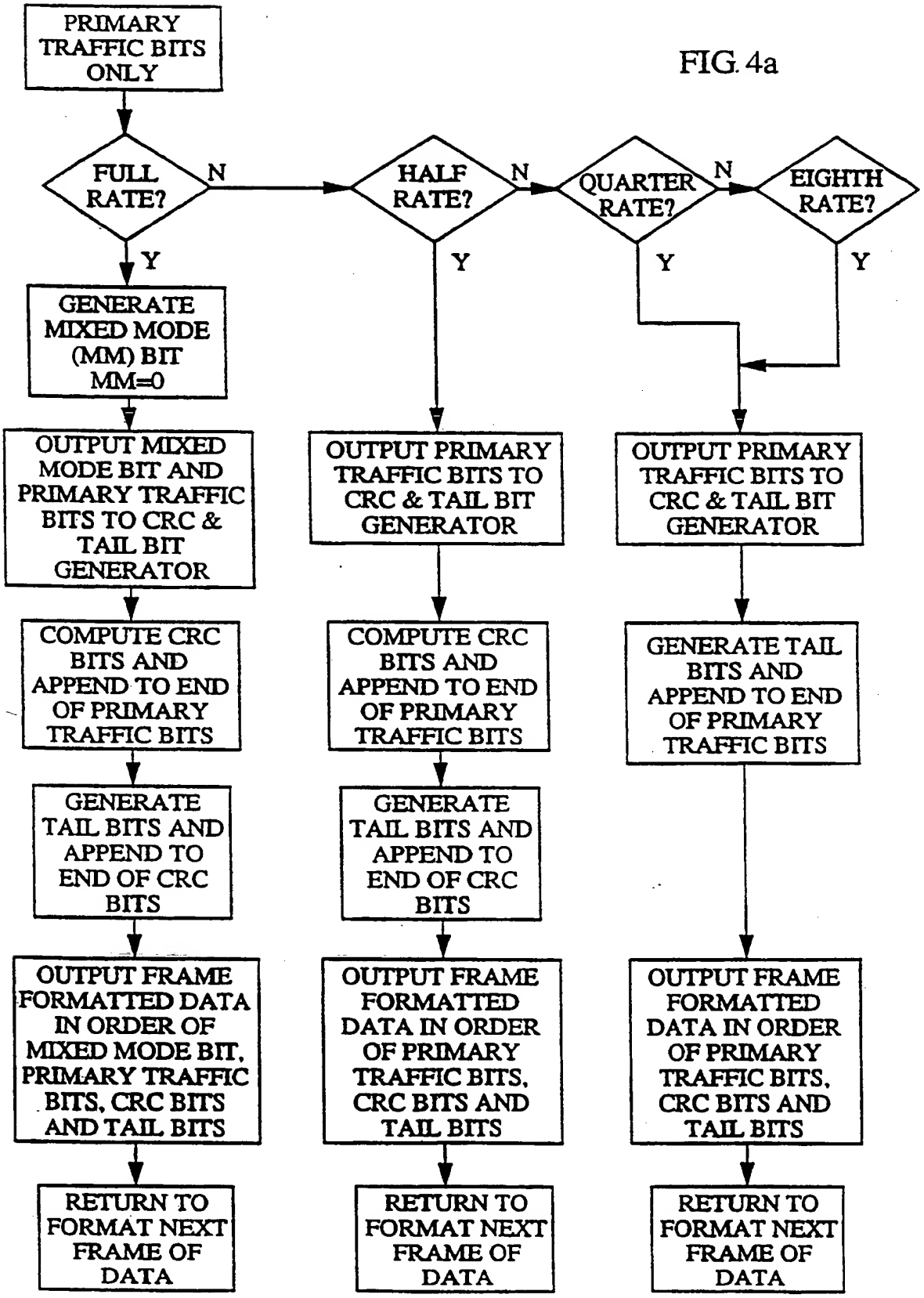


FIG. 4a



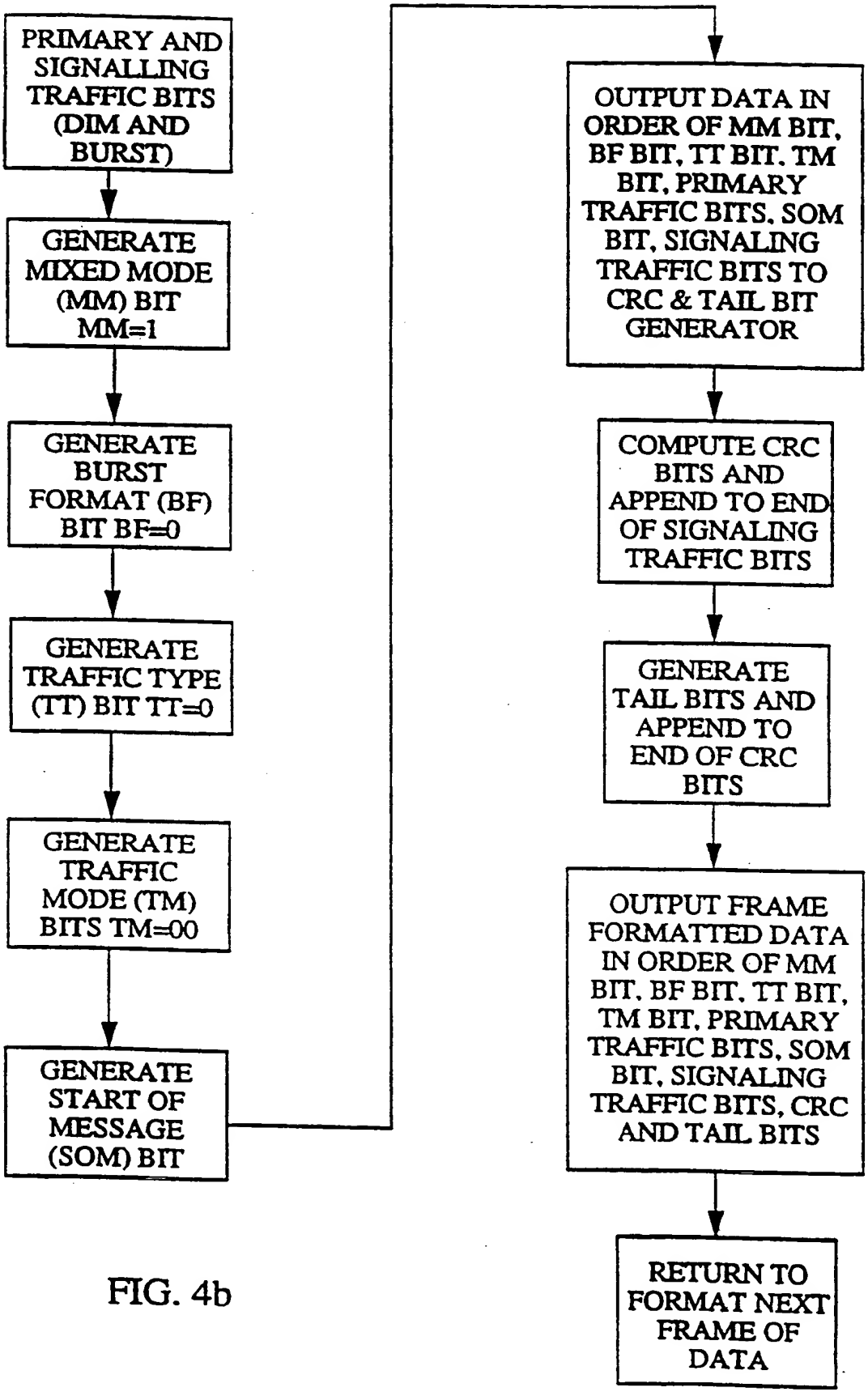


FIG. 4b

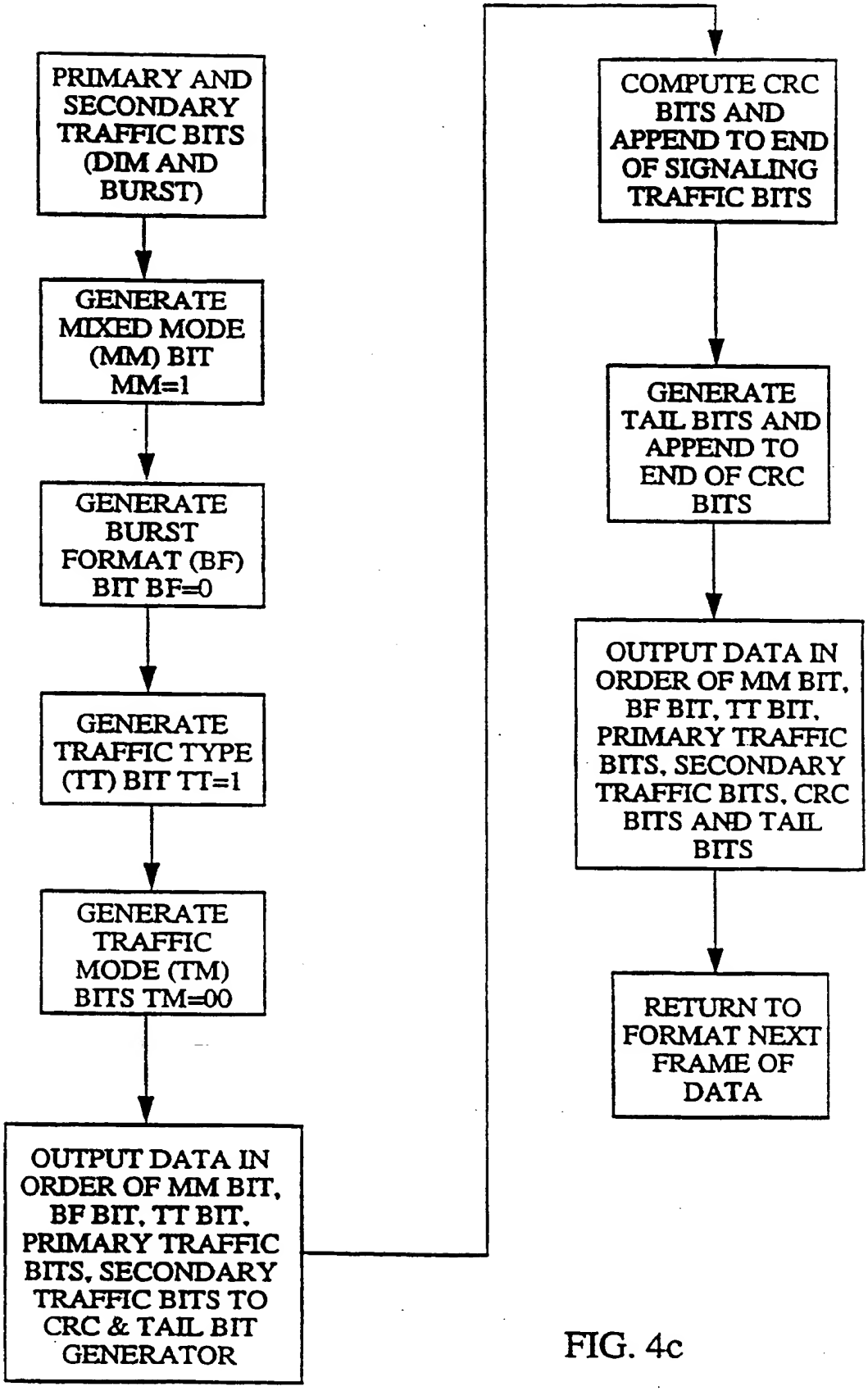


FIG. 4c

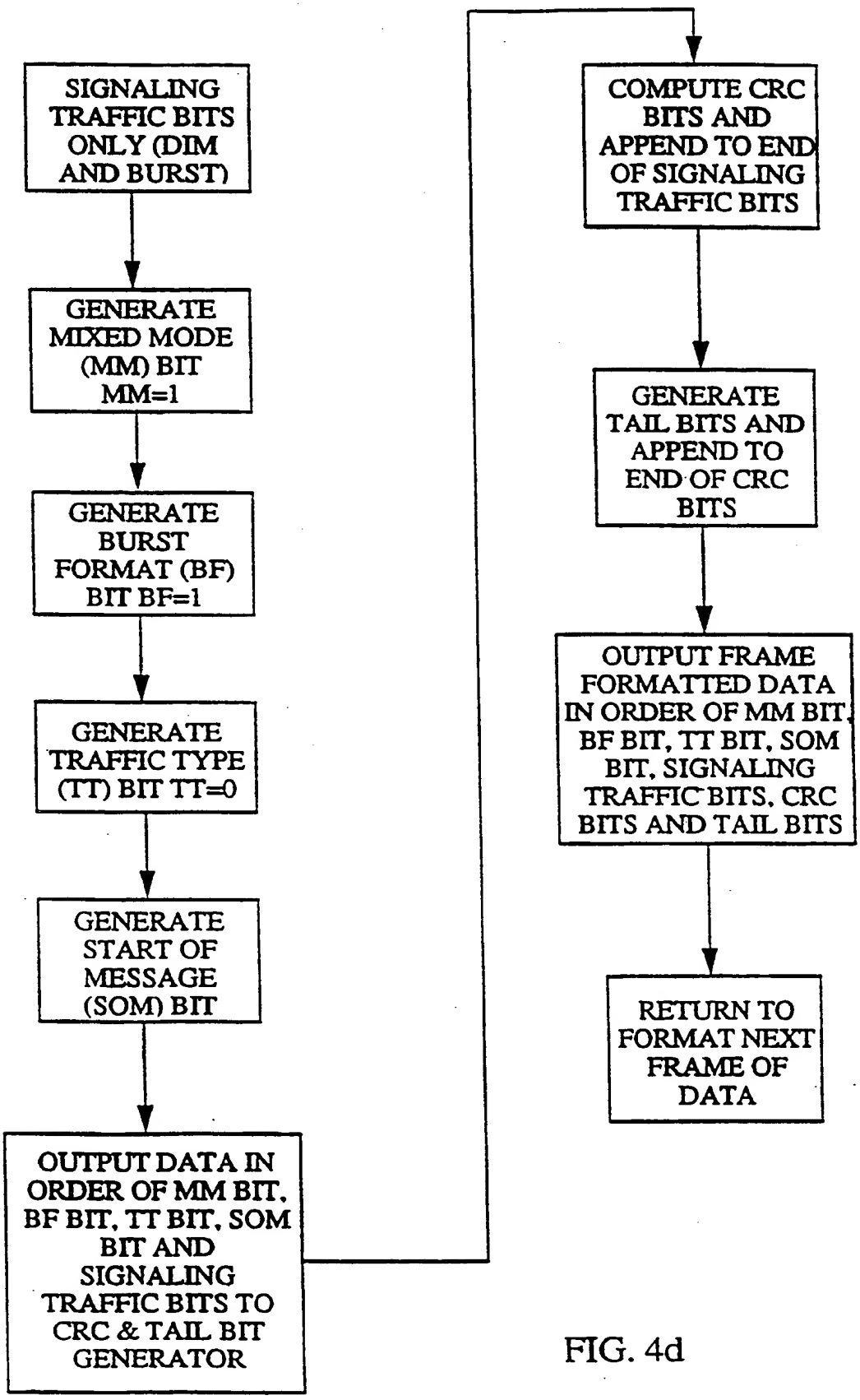


FIG. 4d

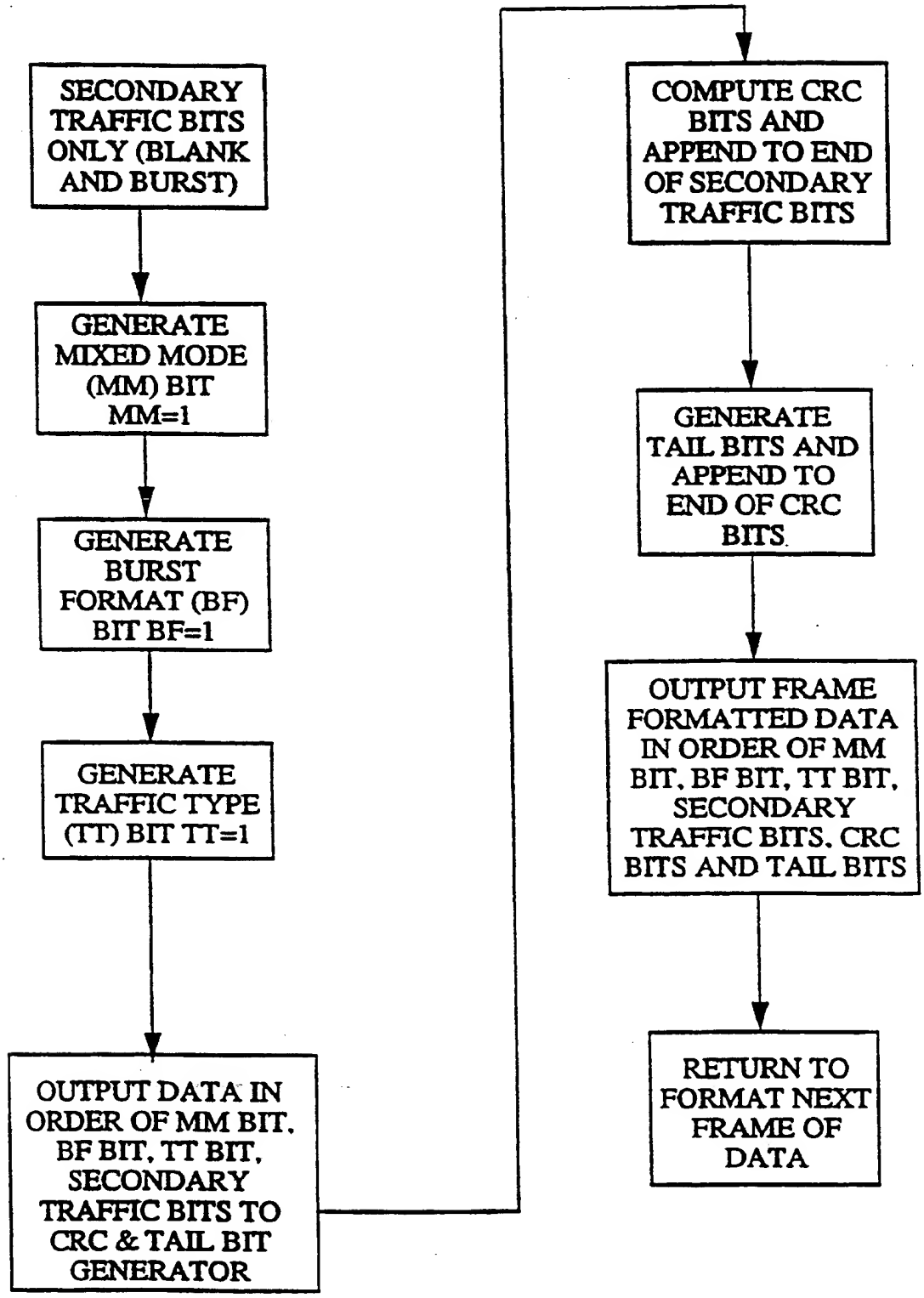


FIG. 4e

1	33	65	97	129	161	193	225	257	289	321	353	385	417	449	481	513	545
2	34	66	98	130	162	194	226	258	290	322	354	386	418	450	482	514	546
3	35	67	99	131	163	195	227	259	291	323	355	387	419	451	483	515	547
4	36	68	100	132	164	196	228	260	292	324	356	388	420	452	484	516	548
5	37	69	101	133	165	197	229	261	293	325	357	389	421	453	485	517	549
6	38	70	102	134	166	198	230	262	294	326	358	390	422	454	486	518	550
7	39	71	103	135	167	199	231	263	295	327	359	391	423	455	487	519	551
8	40	72	104	136	168	200	232	264	296	328	360	392	424	456	488	520	552
9	41	73	105	137	169	201	233	265	297	329	361	393	425	457	489	521	553
10	42	74	106	138	170	202	234	266	298	330	362	394	426	458	490	522	554
11	43	75	107	139	171	203	235	267	299	331	363	395	427	459	491	523	555
12	44	76	108	140	172	204	236	268	300	332	364	396	428	460	492	524	556
13	45	77	109	141	173	205	237	269	301	333	365	397	429	461	493	525	557
14	46	78	110	142	174	206	238	270	302	334	366	398	430	462	494	526	558
15	47	79	111	143	175	207	239	271	303	335	367	399	431	463	495	527	559
16	48	80	112	144	176	208	240	272	304	336	368	400	432	464	496	528	560
17	49	81	113	145	177	209	241	273	305	337	369	401	433	465	497	529	561
18	50	82	114	146	178	210	242	274	306	338	370	402	434	466	498	530	562
19	51	83	115	147	179	211	243	275	307	339	371	403	435	467	499	531	563
20	52	84	116	148	180	212	244	276	308	340	372	404	436	468	500	532	564
21	53	85	117	149	181	213	245	277	309	341	373	405	437	469	501	533	565
22	54	86	118	150	182	214	246	278	310	342	374	406	438	470	502	534	566
23	55	87	119	151	183	215	247	279	311	343	375	407	439	471	503	535	567
24	56	88	120	152	184	216	248	280	312	344	376	408	440	472	504	536	568
25	57	89	121	153	185	217	249	281	313	345	377	409	441	473	505	537	569
26	58	90	122	154	186	218	250	282	314	346	378	410	442	474	506	538	570
27	59	91	123	155	187	219	251	283	315	347	379	411	443	475	507	539	571
28	60	92	124	156	188	220	252	284	316	348	380	412	444	476	508	540	572
29	61	93	125	157	189	221	253	285	317	349	381	413	445	477	509	541	573
30	62	94	126	158	190	222	254	286	318	350	382	414	446	478	510	542	574
31	63	95	127	159	191	223	255	287	319	351	383	415	447	479	511	543	575
32	64	96	128	160	192	224	256	288	320	352	384	416	448	480	512	544	576

FIG. 5a

1	17	33	49	65	81	97	113	129	145	161	177	193	209	225	241	257	273
1	17	33	49	65	81	97	113	129	145	161	177	193	209	225	241	257	273
2	18	34	50	66	82	98	114	130	146	162	178	194	210	226	242	258	274
2	18	34	50	66	82	98	114	130	146	162	178	194	210	226	242	258	274
3	19	35	51	67	83	99	115	131	147	163	179	195	211	227	243	259	275
3	19	35	51	67	83	99	115	131	147	163	179	195	211	227	243	259	275
4	20	36	52	68	84	100	116	132	148	164	180	196	212	228	244	260	276
4	20	36	52	68	84	100	116	132	148	164	180	196	212	228	244	260	276
5	21	37	53	69	85	101	117	133	149	165	181	197	213	229	245	261	277
5	21	37	53	69	85	101	117	133	149	165	181	197	213	229	245	261	277
6	22	38	54	70	86	102	118	134	150	166	182	198	214	230	246	262	278
6	22	38	54	70	86	102	118	134	150	166	182	198	214	230	246	262	278
7	23	39	55	71	87	103	119	135	151	167	183	199	215	231	247	263	279
7	23	39	55	71	87	103	119	135	151	167	183	199	215	231	247	263	279
8	24	40	56	72	88	104	120	136	152	168	184	200	216	232	248	264	280
8	24	40	56	72	88	104	120	136	152	168	184	200	216	232	248	264	280
9	25	41	57	73	89	105	121	137	153	169	185	201	217	233	249	265	281
9	25	41	57	73	89	105	121	137	153	169	185	201	217	233	249	265	281
10	26	42	58	74	90	106	122	138	154	170	186	202	218	234	250	266	282
10	26	42	58	74	90	106	122	138	154	170	186	202	218	234	250	266	282
11	27	43	59	75	91	107	123	139	155	171	187	203	219	235	251	267	283
11	27	43	59	75	91	107	123	139	155	171	187	203	219	235	251	267	283
12	28	44	60	76	92	108	124	140	156	172	188	204	220	236	252	268	284
12	28	44	60	76	92	108	124	140	156	172	188	204	220	236	252	268	284
13	29	45	61	77	93	109	125	141	157	173	189	205	221	237	253	269	285
13	29	45	61	77	93	109	125	141	157	173	189	205	221	237	253	269	285
14	30	46	62	78	94	110	126	142	158	174	190	206	222	238	254	270	286
14	30	46	62	78	94	110	126	142	158	174	190	206	222	238	254	270	286
15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255	271	287
15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255	271	287
16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288
16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288

FIG. 5b

1	9	17	25	33	41	49	57	65	73	81	89	97	105	113	121	129	137
1	9	17	25	33	41	49	57	65	73	81	89	97	105	113	121	129	137
1	9	17	25	33	41	49	57	65	73	81	89	97	105	113	121	129	137
1	9	17	25	33	41	49	57	65	73	81	89	97	105	113	121	129	137
2	10	18	26	34	42	50	58	66	74	82	90	98	106	114	122	130	138
2	10	18	26	34	42	50	58	66	74	82	90	98	106	114	122	130	138
2	10	18	26	34	42	50	58	66	74	82	90	98	106	114	122	130	138
2	10	18	26	34	42	50	58	66	74	82	90	98	106	114	122	130	138
3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139
3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139
3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139
3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139
4	12	20	28	36	44	52	60	68	76	84	92	100	108	116	124	132	140
4	12	20	28	36	44	52	60	68	76	84	92	100	108	116	124	132	140
4	12	20	28	36	44	52	60	68	76	84	92	100	108	116	124	132	140
4	12	20	28	36	44	52	60	68	76	84	92	100	108	116	124	132	140
5	13	21	29	37	45	53	61	69	77	85	93	101	109	117	125	133	141
5	13	21	29	37	45	53	61	69	77	85	93	101	109	117	125	133	141
5	13	21	29	37	45	53	61	69	77	85	93	101	109	117	125	133	141
5	13	21	29	37	45	53	61	69	77	85	93	101	109	117	125	133	141
6	14	22	30	38	46	54	62	70	78	86	94	102	110	118	126	134	142
6	14	22	30	38	46	54	62	70	78	86	94	102	110	118	126	134	142
6	14	22	30	38	46	54	62	70	78	86	94	102	110	118	126	134	142
6	14	22	30	38	46	54	62	70	78	86	94	102	110	118	126	134	142
7	15	23	31	39	47	55	63	71	79	87	95	103	111	119	127	135	143
7	15	23	31	39	47	55	63	71	79	87	95	103	111	119	127	135	143
7	15	23	31	39	47	55	63	71	79	87	95	103	111	119	127	135	143
7	15	23	31	39	47	55	63	71	79	87	95	103	111	119	127	135	143
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144

FIG. 5c

1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69
1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69
1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69
1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69
1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69
1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69
1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69
1	5	9	13	17	21	25	29	33	37	41	45	49	53	57	61	65	69
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59	63	67	71
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59	63	67	71
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59	63	67	71
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59	63	67	71
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59	63	67	71
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59	63	67	71
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59	63	67	71
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59	63	67	71
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72

FIG. 5d

FIG. 6a

WALSH SYMBOL INDEX	WALSH CHIP WITHIN SYMBOL															
	0123	4567	11 8901	1111 2345	1111 6789	2222 0123	2222 4567	2233 8901	3333 2345	3333 6789	4444 0123	4444 4567	4455 8901	5555 2345	5555 6789	6666 0123
0	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
1	0101	0101	0101	0101	0101	0101	0101	0101	0101	0101	0101	0101	0101	0101	0101	0101
2	0011	0011	0011	0011	0011	0011	0011	0011	0011	0011	0011	0011	0011	0011	0011	0011
3	0110	0110	0110	0110	0110	0110	0110	0110	0110	0110	0110	0110	0110	0110	0110	0110
4	0000	1111	0000	1111	0000	1111	0000	1111	0000	1111	0000	1111	0000	1111	0000	1111
5	0101	1010	0101	1010	0101	1010	0101	1010	0101	1010	0101	1010	0101	1010	0101	1010
6	0011	1100	0011	1100	0011	1100	0011	1100	0011	1100	0011	1100	0011	1100	0011	1100
7	0110	1001	0110	1001	0110	1001	0110	1001	0110	1001	0110	1001	0110	1001	0110	1001
8	0000	0000	1111	1111	0000	0000	1111	1111	0000	0000	1111	1111	0000	0000	1111	1111
9	0101	0101	1010	1010	0101	0101	1010	1010	0101	0101	1010	1010	0101	0101	1010	1010
10	0011	0011	1100	1100	0011	0011	1100	1100	0011	0011	1100	1100	0011	0011	1100	1100
11	0110	0110	1001	1001	0110	0110	1001	1001	0110	0110	1001	1001	0110	0110	1001	1001
12	0000	1111	1111	0000	0000	1111	1111	0000	0000	1111	1111	0000	0000	1111	1111	0000
13	0101	1010	1010	0101	0101	1010	1010	0101	0101	1010	1010	0101	0101	1010	1010	0101
14	0011	1100	1100	0011	0011	1100	1100	0011	0011	1100	1100	0011	0011	1100	1100	0011
15	0110	1001	1001	0110	0110	1001	1001	0110	0110	1001	1001	0110	0110	1001	1001	0110
16	0000	0000	0000	0000	1111	1111	1111	1111	0000	0000	0000	0000	1111	1111	1111	1111
17	0101	0101	0101	0101	1010	1010	1010	1010	0101	0101	0101	0101	1010	1010	1010	1010
18	0011	0011	0011	0011	1100	1100	1100	1100	0011	0011	0011	0011	1100	1100	1100	1100
19	0110	0110	0110	0110	1001	1001	1001	1001	0110	0110	0110	0110	1001	1001	1001	1001
20	0000	1111	0000	1111	1111	0000	1111	0000	0000	1111	0000	1111	1111	0000	1111	0000
21	0101	1010	0101	1010	1010	0101	1010	0101	0101	1010	0101	1010	1010	0101	1010	0101
22	0011	1100	0011	1100	1100	0011	1100	0011	0011	1100	0011	1100	1100	0011	1100	0011
23	0110	1001	0110	1001	1001	0110	1001	0110	0110	1001	0110	1001	1001	0110	1001	0110

EP 0 730 356 A2

FIG. 6b

WALSH INDEX	WALSH CHIP WITHIN SYMBOL															
				11	1111	1111	2222	2222	2233	3333	3333	4444	4444	4455	5555	5555	6666
		0123	4567	8901	2345	6789	0123	4567	8901	2345	6789	0123	4567	8901	2345	6789	0123
	24	0000	0000	1111	1111	1111	1111	0000	0000	0000	0000	1111	1111	1111	1111	0000	0000
	25	0101	0101	1010	1010	1010	1010	0101	0101	0101	0101	1010	1010	1010	1010	0101	0101
	26	0011	0011	1100	1100	1100	1100	0011	0011	0011	0011	1100	1100	1100	1100	0011	0011
W	27	0110	0110	1001	1001	1001	1001	0110	0110	0110	0110	1001	1001	1001	1001	0110	0110
A	28	0000	1111	1111	0000	1111	0000	0000	1111	0000	1111	1111	0000	1111	0000	0000	1111
L	29	0101	1010	1010	0101	1010	0101	0101	1010	0101	1010	1010	0101	1010	0101	0101	1010
S	30	0011	1100	1100	0011	1100	0011	0011	1100	0011	1100	1100	0011	1100	0011	0011	1100
H	31	0110	1001	1001	0011	1001	0110	0110	1001	0110	1001	1001	0110	1001	0110	0110	1001
	32	0000	0000	0000	0000	0000	0000	0000	0000	1111	1111	1111	1111	1111	1111	1111	1111
S	33	0101	0101	0101	0101	0101	0101	0101	0101	1010	1010	1010	1010	1010	1010	1010	1010
Y	34	0011	0011	0011	0011	0011	0011	0011	0011	1100	1100	1100	1100	1100	1100	1100	1100
M	35	0110	0110	0110	0110	0110	0110	0110	0110	1001	1001	1001	1001	1001	1001	1001	1001
B	36	0000	1111	0000	1111	0000	1111	0000	1111	1111	0000	1111	0000	1111	0000	1111	0000
O	37	0101	1010	0101	1010	0101	1010	0101	1010	1010	0101	1010	0101	1010	0101	1010	0101
L	38	0011	1100	0011	1100	0011	1100	0011	1100	1100	0011	1100	0011	1100	0011	1100	0011
	39	0110	1001	0110	1001	0110	1001	0110	1001	1001	0110	1001	0110	1001	0110	1001	0110
I	40	0000	0000	1111	1111	0000	0000	1111	1111	1111	1111	0000	0000	1111	1111	0000	0000
N	41	0101	0101	1010	1010	0101	0101	1010	1010	1010	1010	0101	0101	1010	1010	0101	0101
D	42	0011	0011	1100	1100	0011	0011	1100	1100	1100	1100	0011	0011	1100	1100	0011	0011
E	43	0110	0110	1001	1001	0110	0110	1001	1001	1001	1001	0110	0110	1001	1001	0110	0110
X	44	0000	1111	1111	0000	0000	1111	1111	0000	1111	0000	0000	1111	1111	0000	0000	1111
	45	0101	1010	1010	0101	0101	1010	1010	0101	1010	0101	0101	1010	1010	0101	0101	1010
	46	0011	1100	1100	0011	0011	1100	1100	0011	1100	0011	0011	1100	1100	0011	0011	1100
	47	0110	1001	1001	0110	0110	1001	1001	0110	1001	0110	0110	1001	1001	0110	0110	1001

EP 0 730 356 A2

FIG. 6c

WALSH CHIP WITHIN SYMBOL

WALSH SYMBOL INDEX	0123	4567	11 8901	1111 2345	1111 6789	2222 0123	2222 4567	2233 8901	3333 2345	3333 6789	4444 0123	4444 4567	4455 8901	5555 2345	5555 6789	6666 0123
48	0000	0000	0000	0000	1111	1111	1111	1111	1111	1111	1111	1111	0000	0000	0000	0000
49	0101	0101	0101	0101	1010	1010	1010	1010	1010	1010	1010	1010	0101	0101	0101	0101
50	0011	0011	0011	0011	1100	1100	1100	1100	1100	1100	1100	1100	0011	0011	0011	0011
51	0110	0110	0110	0110	1001	1001	1001	1001	1001	1001	1001	1001	0110	0110	0110	0110
52	0000	1111	0000	1111	1111	0000	1111	0000	1111	0000	1111	0000	0000	1111	0000	1111
53	0101	1010	0101	1010	1010	0101	1010	0101	1010	0101	1010	0101	0101	1010	0101	1010
54	0011	1100	0011	1100	1100	0011	1100	0011	1100	0011	1100	0011	0011	1100	0011	1100
55	0110	1001	0110	1001	1001	0110	1001	0110	1001	0110	1001	0110	0110	1001	0110	1001
56	0000	0000	1111	1111	1111	1111	0000	0000	1111	1111	0000	0000	0000	0000	1111	1111
57	0101	0101	1010	1010	1010	1010	0101	0101	1010	1010	0101	0101	0101	0101	1010	1010
58	0011	0011	1100	1100	1100	1100	0011	0011	1100	1100	0011	0011	0011	0011	1100	1100
59	0110	0110	1001	1001	1001	1001	0110	0110	1001	1001	0110	0110	0110	0110	1001	1001
60	0000	1111	1111	0000	1111	0000	0000	1111	1111	0000	0000	1111	0000	1111	1111	0000
61	0101	1010	1010	0101	1010	0101	0101	1010	1010	0101	0101	1010	0101	1010	1010	0101
62	0011	1100	1100	0011	1100	0011	0011	1100	1100	0011	0011	1100	0011	1100	1100	0011
63	0110	1001	1001	0110	1001	0110	0110	1001	1001	0110	0110	1001	0110	1001	1001	0110

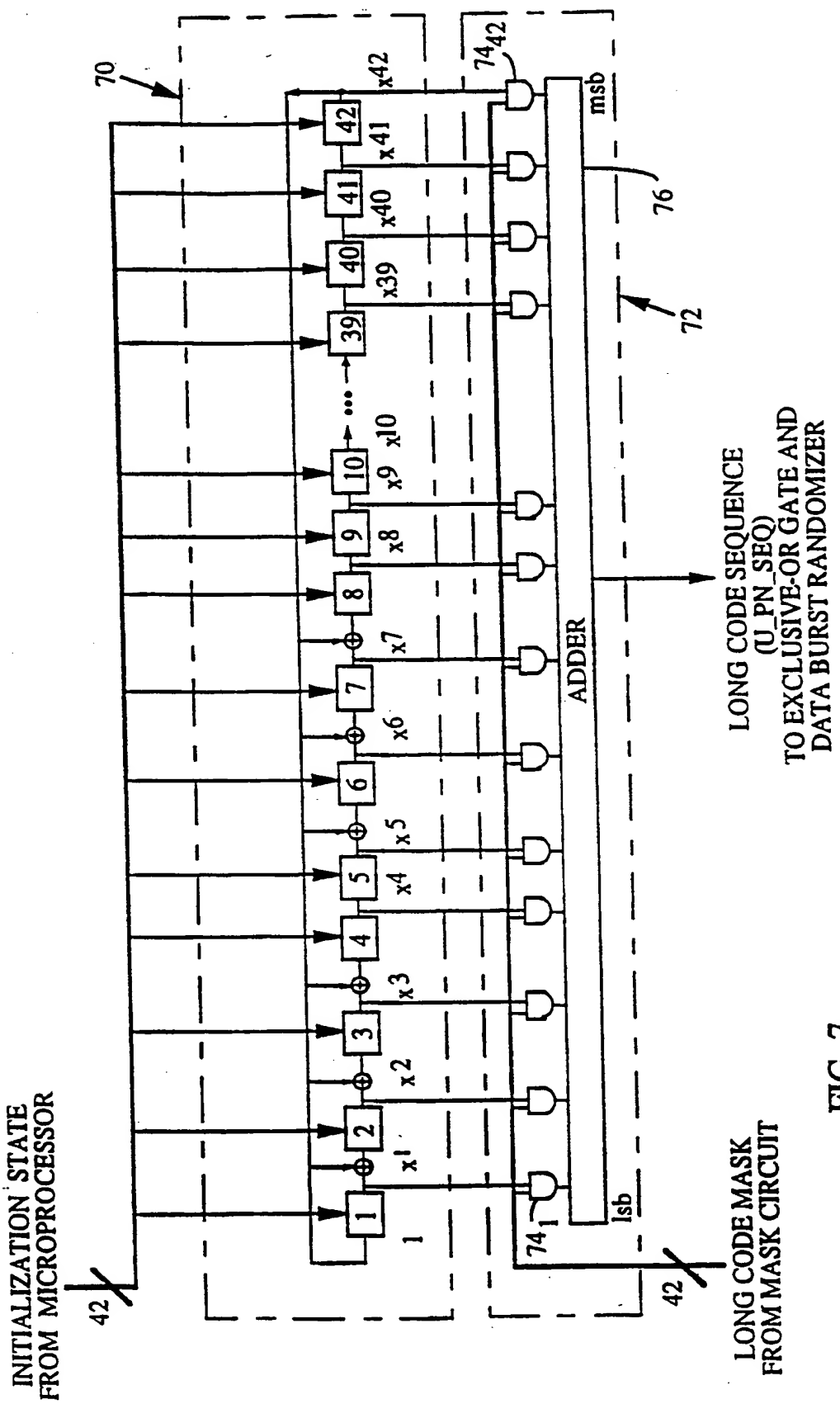


FIG. 7

ACCESS CHANNEL LONG CODE MASK

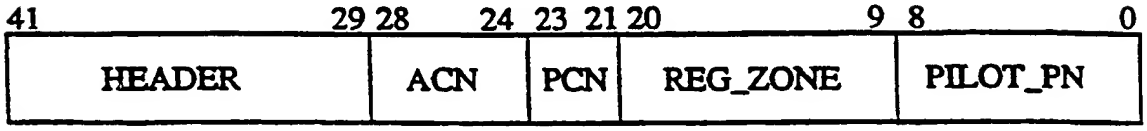


FIG. 8a

PUBLIC LONG CODE MASK

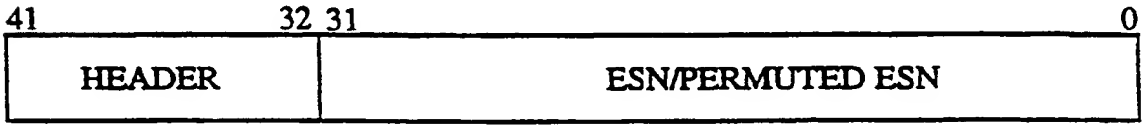


FIG. 8b

PRIVATE LONG CODE MASK

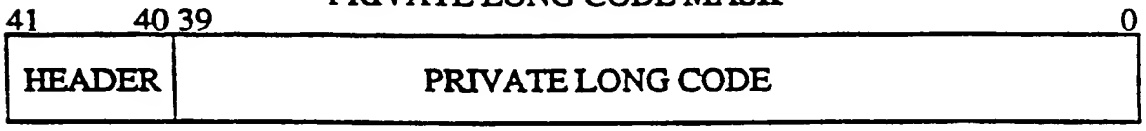


FIG. 8c

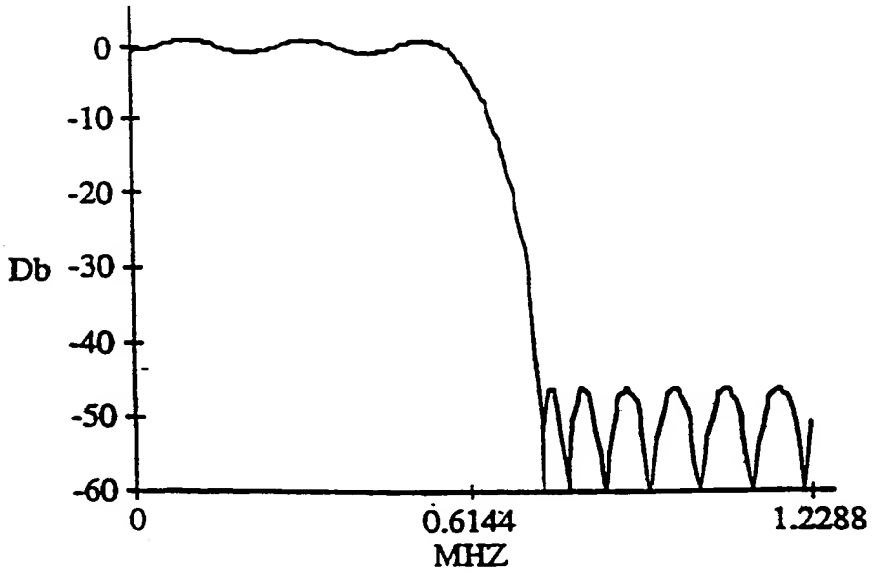


FIG. 9

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(54) Communication system and method for transmitting data of different types

(57) The invention relates to a communication system in which transmission takes place according to a format which permits different types of data to be combined and transmitted within a single transmission. The novel feature is that the communication system transmits variable length frames of data in packets, and that a data combining and transmission sub-system (14, 16, 18, 20) is provided so that when a frame of data does not require a complete packet for transmission, the data combining sub-system combines the frame of data with additional data to provide a complete packet. The data combining sub-system comprises input means for receiving the frame of data and the additional data and for combining the frame of data and the additional data to provide a complete packet responsive to a control signal, and control means for providing the control signal.

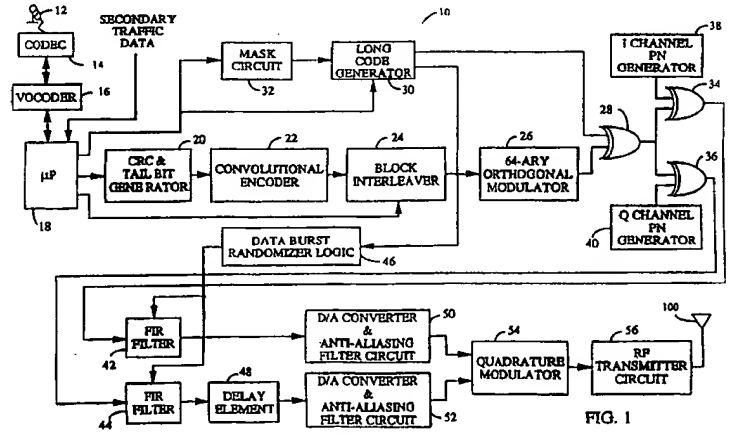

FIG. 1

EP 0 730 356 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 10 8491

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP-A-0 381 515 (NEC CORPORATION) * page 2, column 2, line 15 - page 3, column 3, line 21 *	1-4,9-11	H04L1/00
X	WO-A-88 04496 (PLESSEY OVERSEAS LIMITED) * page 2, line 11 - line 13 *	1,9	
X	US-A-4 691 314 (BERGINS ET AL.) * column 5, line 63 - column 6, line 17 *	1,9	
A	EP-A-0 189 695 (MOULY MICHEL) * claim 1 *	6,7,12, 13	
A	US-A-4 852 179 (FETTE) * column 2, line 5 - line 30 *	8	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H04L
H04J
H04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 September 1996	Bischof, J-L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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(54) Adaptive communication data formatting

(57) The present invention is a method for improving data transfer performance over communications networks connecting data networks and users using adaptive communications formatting. Adaptive communications formatting includes encoding (or compressing) the data and applying error control schemes to reduce the amount of data being transmitted and to correct and/or conceal errors occurring during data transmission. In one embodiment, the present invention uses a set of transcoding techniques to encode (or compress) the data and a set of error control schemes to correct and/or conceal errors occurring during data transmission. The particular sets of transcoding techniques and error control schemes selected to format the data are adaptive to factors, such as the nature of the communications network connecting a user to an access server on the data network, the preferences of the user, and the data type of the data being transmitted to the user (or the access server).

EP 0 905 939 A2

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Description

BACKGROUND OF THE INVENTION

[0001] Subscribers of wireless communications systems are increasing to phenomenal numbers with more than forty-five million subscribers in the United States and one-hundred and twenty million subscribers worldwide. As new service providers enter the wireless communication market, the level of competition for old service providers increases to retain existing customer base while attracting new subscribers. To maintain continued growth of subscriber numbers and revenue levels, service providers are offering value-added services to their subscribers.

[0002] The Internet explosion has provided service providers of wired and wireless communications systems with a direction for developing value-added services. Currently, there are more than fifty million users of the Internet. Access to the Internet is typically via a wired communication network. However, wired Internet access requires some type of physical connection between the users and the wired communications network. Thus, the mobility of users accessing the Internet via a wired connection is severely limited. By contrast, access to the Internet via a wireless communications system offers a great deal of mobility to users/subscribers. However, wireless Internet access can be prohibitively expensive to most users/subscribers. Specifically, wireless communications systems, such as those based on the GSM and IS-95 CDMA standards, are limited in air interface access speeds (i.e., narrow bandwidth) and are subjected to an error prone transmission environment. For example, data transmitted over an IS-95 CDMA based wireless communication systems may be subject to a 3% or more bit error rate. Such limitations increase the amount of time required for successful data transfers between the Internet and the user/subscriber which, in turn, increases the cost of a wireless telephone call to the user/subscriber. Accordingly, there exists a need to improve data transfer performance (i.e., reduce transmission time) over communication networks connecting the Internet or other data networks to the user/subscriber.

SUMMARY OF THE INVENTION

[0003] The present invention is a method for improving data transfer performance over communications networks connecting data networks and users using adaptive communications formatting. Adaptive communications formatting includes encoding (or compressing) the data and applying error control schemes to reduce the amount of data being transmitted and to correct and/or conceal errors occurring during data transmission. In one embodiment, the present invention uses a set of transcoding techniques to encode (or compress) the data and a set of error control schemes to correct and/or conceal errors occurring during data transmission. The particular sets of transcoding techniques and error control schemes selected to format the data are adaptive to factors, such as the nature of the communications network connecting a user to an access server on the data network, the preferences of the user, and the data type of the data being transmitted to the user (or the access server).

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings where:

FIG. 1 depicts an architecture for a system for accessing a data network in accordance with the present invention;
FIG. 2 depicts a bitstream entering and exiting the access server;
FIG. 3 depicts a functional block diagram of the access server in accordance with one embodiment of the present invention;
FIG. 4 depicts a table for selecting transcoding techniques and error control schemes to use to format data; and
FIG. 5 depicts a chart illustrating examples transcoding techniques and error control schemes which might be used for transmission of particular data types over wireless connections.

DETAILED DESCRIPTION

[0005] FIG. 1 illustrates an architecture for a system 10 for accessing a data network in accordance with the present invention. The system 10 comprises a data network 12 (e.g., the Internet), a user 14, and a communications network 16. The communications network 16 comprises a plurality of wired and/or wireless communications systems for providing a wired and/or wireless connection between the data network 12 and the user 14. Wired communications systems include Public Switching Telephone Networks (PSTN), Integrated Switching Digital Networks (ISDN), T1 lines and E1 lines. Wireless communications systems include those based on Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA). The data network 12 comprises a plurality of interconnected computers including at least one access server 20 and at least one host 22. The access server 20 being a computer associated with a service provider to which the user 14 subscribes for accessing the data network 12. The host 22 being a computer having data sought by the user 14. The access server 20 and the host 22 may also be the same computer.

[0006] The user 14 comprises a communication de-

vice 24 (e.g., telephone, mobile-telephone and/or modem) for receiving and transmitting data from and to the access server 20 via the communications network 16, and a remote computer 26 having software for processing data for transmission to the access server 20 or for display on an output device associated with the remote computer 26, such as a video display, an audio display, a printer, memory, etc. The user 14 gains access to the data network 12 through the access server 20. Specifically, the user 14 dials a number associated with the access server 20. The communication network 16 connects the user 14 to the access server 20 using the dialed number. Upon connecting to the access server 20, the user 14 can retrieve data from the host 22.

[0007] In general, data (being retrieved by the user) may be in the form of a file or an output of a real time recording device, such as a video camera, microphone, scanner, fax, transducers or measuring devices. In all cases, the data will have associated information indicating a data type for the data. For purposes of discussion, the present invention will be described herein as retrieving data in the form of a file from the host 22. It should not be construed, however, to limit the present invention to retrieving data in the form of a file.

[0008] The data (or file) is retrieved via a bitstream from the host 22 to the access server 20 to the user 14. The bitstream includes the data and control information. The data has associated a filename with a file extension indicative of a data type (and/or sub-type). The control information includes a user indicator for identifying the user to whom the data is intended, error control information for correcting and/or concealing errors occurring during data transmission, and/or a data type indicator to identify the data type of the associated data. Data types include, but are not limited to, speech/voice, video/image and text. Each data type has one or more sub-types. Examples of speech/voice sub-types (and file extensions) include audio (.au), wave (.wav) and speech (.sp). Examples of video/image sub-types include tagged image format files (.tif), graphic image format files (.gif), Moving Picture Experts Group files (.mpg and .mp2). Examples of text sub-types include MS Word (.doc) and ASCII (.txt).

Adaptive Communications Formatting

[0009] At the access server 20, the data is formatted using a mixture of transcoding techniques and error control schemes to facilitate data transmission within acceptable quality levels, as will be described herein. FIG. 2 illustrates a bitstream 23 entering and a bitstream 25 exiting the access server 20. When the bitstream 23 arrives at the access server, the bitstream 23 includes the data and user indicator-control information for identifying the user to whom the data is intended. The data is formatted by the access server 20 and transmitted to the user 14 via the bitstream 25, which includes encoded data, error control information for controlling and/or concealing errors resulting from data transmission, and data type indicator-control information for identifying the data type of the associated (encoded) data, as will be described herein

[0010] Transcoding techniques include encoding algorithms for encoding (or compressing) the data. Encoding (or compressing) the data facilitates data transmission by reducing the amount of data to be transmitted which, in turn, decreases the time required to transmit the data (i.e., transmission time) from the access server to the user over a transmission channel of limited bandwidth (i.e., slower access speeds). Some encoding algorithms, however, have associated loss that may adversely affect data quality. Algebraic Code Excited Linear Prediction (ACELP), Vector Sum Excited Linear Prediction (VSELP), Enhanced Variable Rate Coder (EVRC), h.263 (which is a set of guidelines being considered by the International Telecommunications Union for implementation into standards), pkzip (by PKWare, Inc.), MPEG and MPEG2 (Moving Pictures Experts Group), and JPEG (Joint Pictures Experts Group) are some examples of encoding algorithms which are well-known in the art. Each of the aforementioned encoding algorithms have associated different levels or percentages of compression.

[0011] Error control schemes include techniques for correcting and/or concealing errors occurring during the transmission of data from the access server 20 to the user 14. Error control schemes provide means for assuring data integrity has not be compromised beyond acceptable levels. Some error control schemes, however, increase data transmission time by adding control information to the data and/or requiring retransmissions of the data when data error is detected. Forward Error Correction (FEC), Cyclical Redundancy Check (CRC), Automatic Retransmission Query (ARQ), hybrid ARQ (i.e., combination of ARQ and FEC) and error concealment (e.g., muting, extrapolation from previous good frames, and interpolation from previous and succeeding good frames) are some examples of error control schemes which are well-known in the art. Each of the aforementioned error control schemes have associated different levels of error correction and/or concealment.

[0012] The particular transcoding techniques and error control schemes used to format the data should be adaptive to factors such as the nature of the communications network 16 connecting the user 14 to the access server 20, the preferences of the user 14, and the data type of the data, as will be discuss herein. Note that the present invention should not be limited to being adaptive to only the aforementioned factors. Other factors, such as interactivity, bit rate and transmission delay, may also be applicable.

First Factor

[0013] The first factor involves the nature of the communications network 16 connecting the user 14 to the

access server 20. The nature of communications systems, in general (regardless of whether the communication system is wired or wireless), varies from one to another. The nature of communications system depends on sub-factors such as whether the communications system is wired or wireless, whether the communications system is analog or digital, the available bandwidth, the bit rate, the signal-to-noise ratio, the bit error rate and the transmission delay, as will be described herein.

[0014] As mentioned earlier, the communications network 16 comprises a plurality of wired and/or wireless communication systems for providing the user 14 with either a wired or a wireless connection to the access server 20. For purposes of discussion, a wireless connection involves using at least one wireless communication system to connect the user 14 to the access server 20. By contrast, a wired connection involves using no wireless communication system to connect the user 14 to the access server 20. Wireless connections have several distinct disadvantages over wired connections. First, the transmission times for data over wireless connections are typically greater than the transmission times for the same data over wired connections. The reasons for this are because wireless connections generally have less available bandwidth, lower bit rates and longer transmission delays than wired connections. Therefore, it may be desirable to use a transcoding technique that will encode (or compress) the data as much as possible to reduce the transmission time over wireless connections (and perhaps some wired connections). The benefits realized in facilitating data transmission should, however, be balanced against losses associated with compression (or encoding).

[0015] Second, data transmitted over a wireless connection is more susceptible to data error than data transmitted over a wired connections. The reasons for this are because wireless connections generally have lower signal-to-noise ratios and higher bit error rates than wired connections. Therefore, it may be desirable to increase the amount of error control being applied to data transmissions over wireless connections. The benefits of increased error control (i.e., increased quality) should, however, be balanced against increased data transmission time.

Second Factor

[0016] The second factor involves the preferences of the user 14. The preferences of the user 14 should reflect the hardware and software capabilities of the user 14 and the access server 20, and a balancing between facilitating data transfer and acceptable data quality. The service provider and the subscribers should agree on the manner in which the data is to be formatted, i.e., agree on which transcoding techniques and error control schemes to use. Whatever manner is used by the access server 20 to format the data, the user 14 should be able to un-format the formatted data. In other words, the access server 20 should agree to use transcoding techniques and error control schemes compatible with transcoding techniques and error control schemes available at the user 14. Failure to use compatible transcoding techniques and error control schemes will result in the user 14 receiving a bitstream that it can not unformat. This agreement may be negotiated between the service provider and subscriber before or at the time the user connects to the access server 20. Preferences of the user 14 should also reflect a balancing by the user between facilitating data transfer and acceptable data quality. For example, if the user 14 requires high quality data, the user 14 might have to trade-off facilitating data transfer for increased data quality. Thus, the user 14 might select a transcoding technique with less compression and minimal loss (e.g., pkzip) and an error control scheme with greater error correction (e.g., ARQ) for formatting the data at the access server.

Third Factor

[0017] The third factor is the data type of the data. Certain transcoding techniques and error control schemes are more effective when used to format particular data types. Thus, the transcoding techniques and error control schemes selected to format the data should be adaptive to the data type, as will be described herein. Transcoding techniques include encoding algorithms for encoding or compressing particular data types: gzip and pkzip for text data; VCELP, ASELP and EVRC for speech/voice data; and h.263 for video/image data. Using a text transcoding technique (e.g., a transcoding technique with gzip) to compress speech/voice data may not be as effective as using a speech transcoding technique (e.g., a transcoding technique with VCELP) to compress the same data - that is, the amount of data compression may not be the same.

[0018] Error control schemes include techniques for different levels of error correction and/or concealment. The level or error correction and/or concealment applied to data should depend on the amount of error tolerable by the user which, in turn, depends on the data type. For example, errors in audio/speech and video/image data types may be tolerable to some extent. In such cases, errors in audio/speech data types may best be concealed by muting, and errors in video/image data types may best be concealed by interpolating from previous good frames. By contrast, errors in text data types may be intolerable. In this case, errors are corrected (not concealed) by requesting retransmissions of the data, i.e., ARQ.

[0019] FIG. 3 is a functional block diagram of the access server 20 in accordance with one embodiment of the present invention. The access server 20 comprises a data selector 30, a plurality of text, speech/voice and video/image transcoding techniques 32-*n* (i.e., transcoding techniques for text, speech/voice and video/im-

age data types), a plurality of text, speech/voice and video/image error control schemes 34-*n* (i.e., error control schemes for text, speech/voice and video/image data types) and a combiner 38 for multiplexing formatted data. The data selector 30 is a device, such as a microprocessor with software, for selecting a transcoding technique 32-n and an error control scheme 34-*n* for formatting the data. The transcoding technique 32-n and error control scheme 34-*n* is selected using the data type, the identity of the user, and/or a user table 40 specifying user preferences (i.e., transcoding techniques and error control schemes preferred by each user for each data type and/or sub-type). The data selector 30 can determine the data type using the file extension, other information contained within the bitstream, default data types and/or a combination of the aforementioned. For example, the data selector 30 may determine data with .wav file extensions are speech/voice data types. The data selector 30 can determine the identity of the user using the user indicator-control information (in the bitstream). Note that FIG. 3 shows an one-on-one correlation between the transcoding techniques and error control schemes. This should not, however, be construed to limit the present invention to embodiments with such a correlation. One-to-many correlation between transcoding techniques and error control schemes, or vice-versa, are also possible.

[0020] FIG. 4 illustrates an example of a user table 40. The transcoding techniques and error control schemes in the table 40 specified for each user and data type (and/or sub-type) should reflect the aforementioned factors, i.e., the nature of the communications network connecting the user to the access server, the equipment and software capabilities and/or preferences of the user and the access server, and the data type of the data. For example, suppose user number 000001 connects to the access server using a wireless connection. The table 40 specifies for user number 000001 a set of transcoding techniques and error control schemes for each data type (and/or sub-type) that are available to both user number 000001 and the access server and will facilitate data transmission within acceptable quality levels over a wireless connection. By contrast, user number 000222 is connected to the access server 20 via a wired connection. For users connected via a wired connection (e.g., user number 000222), the table 40 specifies no formatting (i.e., no transcoding techniques or error control schemes) because wired connections (with broader bandwidths) are less prone to error than narrower bandwidth wireless connections.

[0021] Note that the present invention should not be limited to using the table 40 depicted in FIG. 4. Other types of tables or collections of information, such as databases, may also be used to specify transcoding techniques and error control schemes for formatting data intended for particular users. Other information may also be stored in the table, such as an indication whether the user is connected via a wired or wireless connection, or separate sets of transcoding techniques and error control schemes for wired and wireless connections. Note that if the data selector needs to make a determination regarding the manner in which the user is connected to the access server, such a determination can be made using a flag indicative of the connection, a default, the telephone number dialed by the user to connect to the access server, etc.

[0022] The access server 20 may create or obtain the table 40 in a variety of manners. The subscriber may submit a competed form to the service provider indicating the transcoding techniques and error control schemes available to the user and the manner in which the user will connect to the access server. The service provider will use the information in the completed form to select transcoding techniques and error control schemes available to both the user and the access server, and optimal for the manner of connection. Such selections are then added to or used to build the table 40. Alternately, the user may provide such information electronically when accessing the access server 20 or the table may be constructed using default sets of transcoding techniques and error control schemes.

[0023] After the data selector 30 selects a transcoding technique and an error control scheme, the selected transcoding technique 32-*n* is used to encode (or compress) the data and the selected error control scheme 34-*n* is used to add error control information to the encoded data, as shown by the bitstream 25 in FIG. 2. Data type indicator-control information is then added to the formatted data (i.e., encoded data with associated error control information) when the formatted data is being multiplexed by the combiner 38. The multiplexed data is subsequently caused to be transmitted by the access server 20 to the user 14 over the communications network 16. At the user 14, the multiplexed data is de-multiplexed and un-formatted using the appropriate sets of transcoding techniques and error control schemes. Specifically, the user 14 looks at the data type indicator-control information to select the appropriate transcoding techniques and error control schemes for un-formatting (or reciprocating the operations of the transcoding techniques and error control schemes at the access server) the formatted data. The un-formatted data is subsequently output to a video display, audio display, printer and/or computer memory associated with the remote computer 26.

[0024] FIG. 5 is a chart 50 illustrating examples transcoding techniques and error control schemes which might be used for transmission of particular data types over wireless connections. The chart 50 shows data sub-types and their associated bit rates, encoding algorithms and the bit rate of the data after encoding (or compression), and error control schemes. For example, data with an audio sub-type has a 256 Kbps bit rate. If a transcoding technique with a VCELP encoding algorithm is used to encode the audio data, the bit rate can be reduced to 8 Kbps. Subsequently, hybrid ARQ and muting

(a form of error concealment) is applied to the encoded (or compressed) data in the error control scheme before being transmitted over a wireless connection.

[0025] Although the present invention has been described in considerable detail with reference to certain embodiments, other versions are possible. Therefore, the spirit and scope of the present invention should not be limited to the description of the embodiments contained herein.

Claims

1. A method for transmitting data over a communications network, the method CHARACTERIZED BY the steps of:

   determining a data type for the data;
   selecting a transcoding technique and an error control scheme to format the data based on the data type;
   encoding the data using the selected transcoding technique; and
   applying the selected error control scheme to the data.

2. The method of claim 1 CHARACTERIZED BY the additional step of: multiplexing the data for transmission over the communications network.

3. The method of claim 2, CHARACTERIZED IN THAT the step of multiplexing includes adding a data type indicator to the data.

4. The method of claim 1, CHARACTERIZED IN THAT the selected error control scheme adds error control information to the data.

5. The method of claim 1, CHARACTERIZED IN THAT the transcoding technique and error control scheme are also selected based on nature of the communications network.

6. The method of claim 1, CHARACTERIZED IN THAT the transcoding technique and error control scheme are also selected based on preferences of a user.

7. The method of claim 1, CHARACTERIZED IN THAT the transcoding techniques and error control schemes are selected using information specifying a set of transcoding techniques and error control schemes for each user.

8. The method of claim 1, CHARACTERIZED IN THAT the transcoding techniques and error control schemes are selected using information specifying a set of transcoding techniques and error control schemes for a wireless connection between an access server and a user.

9. A method for transmitting data over a communication network, the method CHARACTERIZED BY the steps of:

   selecting a transcoding technique and an error control scheme to format the data based on whether the communications network includes a wireless communications system;
   encoding the data using the selected transcoding technique if the communications network is a wireless communications system; and
   applying the selected error control scheme to the data if the communications network is a wireless communications System.

10. A method for transmitting data over a communications network, the method CHARACTERIZED BY the steps of:

    selecting a transcoding technique and an error control scheme to format the data based on user preferences;
    encoding the data using the selected transcoding technique; and
    applying the selected error control scheme to the data.

FIG. 1

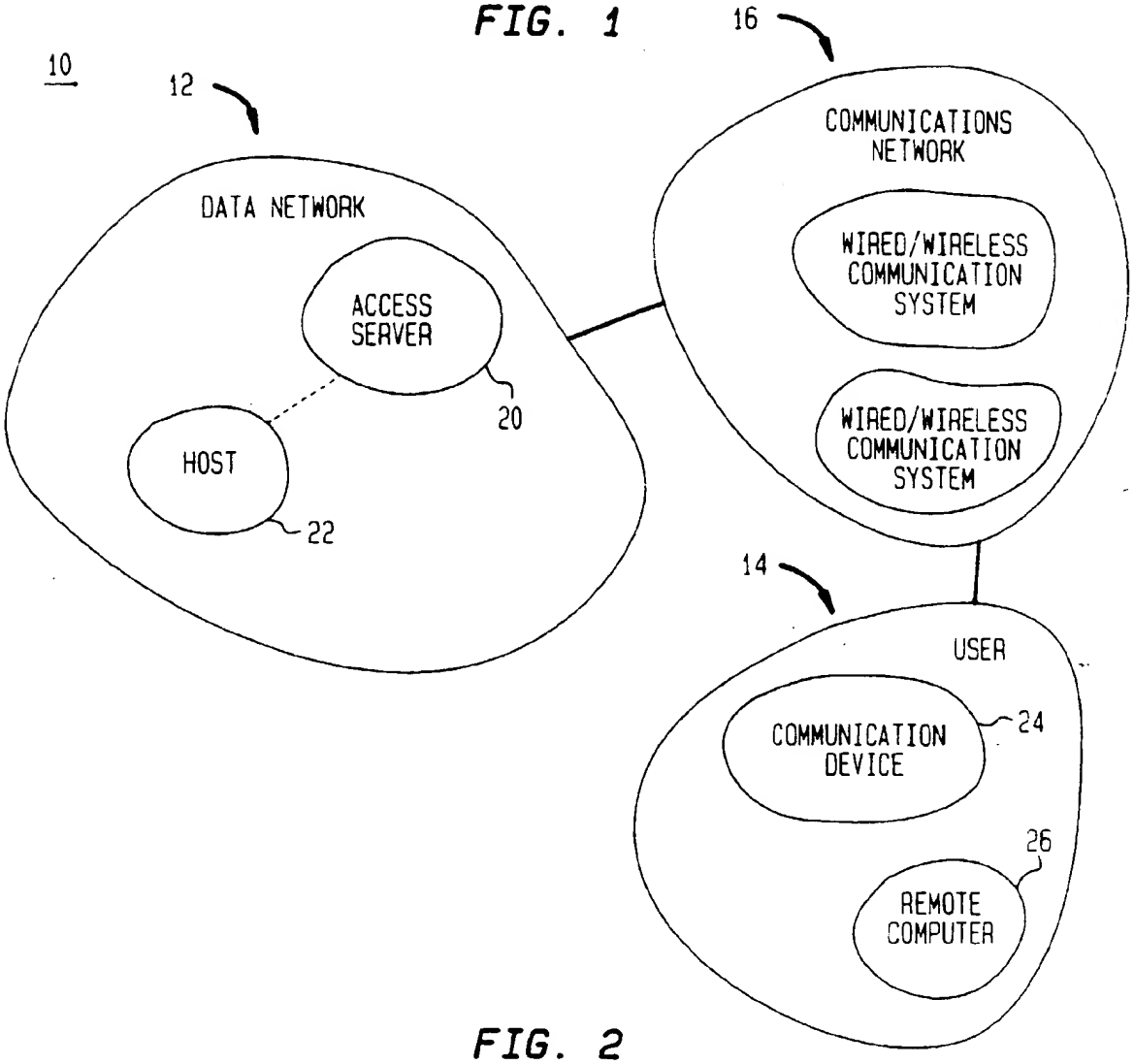
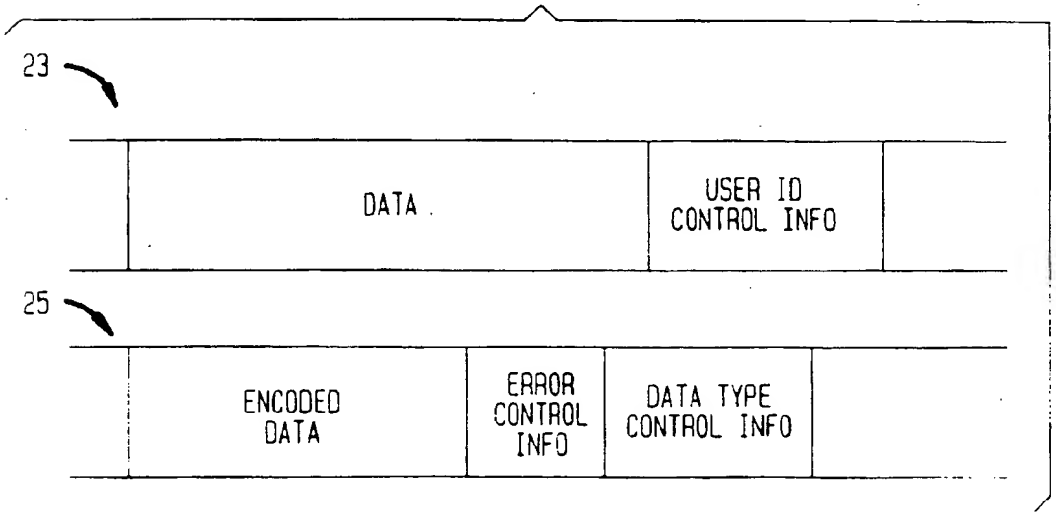


FIG. 2



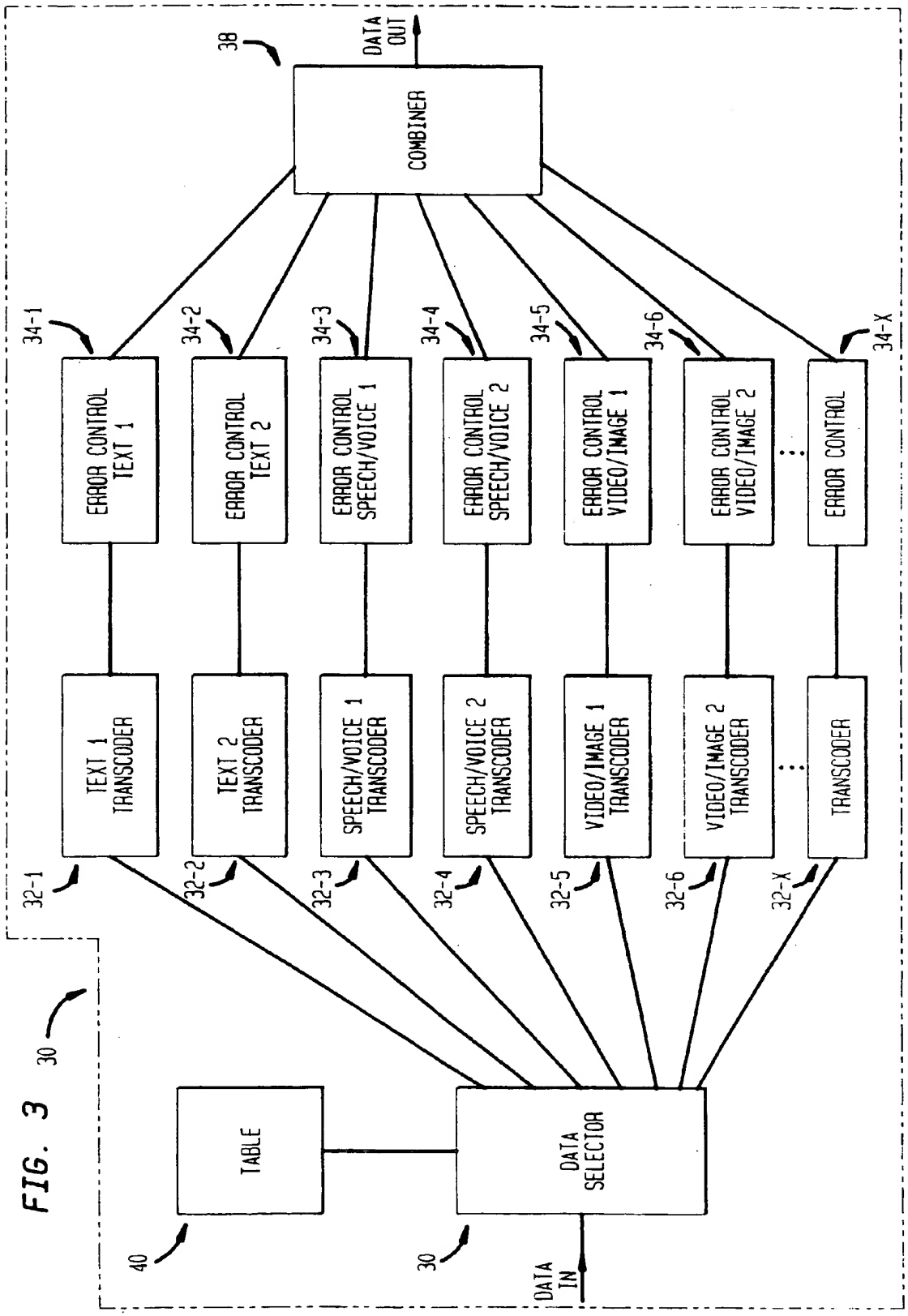


FIG. 3

40

FIG. 4

USER #	DATA TYPES					
	TEXT		SPEECH/VOICE		VIDEO/IMAGE	
	TRANSCODER	ADAPTATION LAYER	TRANSCODER	ADAPTATION LAYER	TRANSCODER	ADAPTATION LAYER
000001	TEXT 1	TEXT 1	SPEECH/VOICE 2	SPEECH/VOICE 2	VIDEO/IMAGE 1	VIDEO/IMAGE 1
000100	TEXT 2	TEXT 2	SPEECH/VOICE 1	SPEECH/VOICE 1	VIDEO/IMAGE 1	VIDEO/IMAGE 1
000200	TEXT 2	TEXT 2	SPEECH/VOICE 2	SPEECH/VOICE 2	VIDEO/IMAGE 2	VIDEO/IMAGE 2
000222	NONE	NONE	NONE	NONE	NONE	NONE
000300	TEXT 1	TEXT 1	SPEECH/VOICE 2	SPEECH/VOICE 2	VIDEO/IMAGE 1	VIDEO/IMAGE 1
000333	TEXT 1	TEXT 1	SPEECH/VOICE 1	SPEECH/VOICE 1	VIDEO/IMAGE 1	VIDEO/IMAGE 1
004000	TEXT 2	TEXT 2	SPEECH/VOICE 1	SPEECH/VOICE 1	VIDEO/IMAGE 2	VIDEO/IMAGE 2

EP 0 905 939 A2

FIG. 5

50

DATA TYPE	SUB-TYPES (BIT RATE)	TRANSCODER ENCODING ALGORITHMS (BIT RATE)	ADAPTATION LAYERS
SPEECH/VOICE	AUDIO (256 Kbps) WAVE (64 Kbps) SPEECH (32 Kbps)	VCELP (8Kbps) VSEOP (8Kbps) EDRU (4-8 Kbps)	HYBRID ARQ ERROR CONCEALMENT (MUTING)
VIDEO/IMAGE	TIFF GIFF MPEG (1.5Mbps) MPEG2 (2.0 Mbps)	H.263 (8-24 Kbps)	HYBRID ARQ ERROR CONCEALMENT (INTERPOLATION)
TEXT	ASCII MSWORD	GZIP PKZIP	ARQ

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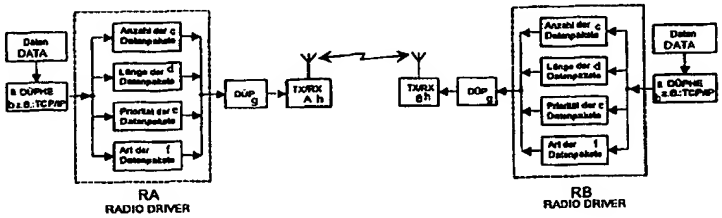
(54) Bezeichnung: ANORDNUNG ZUM OPTIMIEREN DER DATENÜBERTRAGUNG ÜBER EINEN BIDIREKTIONALEN FUNKKANAL



(57) Abstract

The invention relates to an arrangement for optimizing the data transmission over a bidirectional radio channel. According to the invention, the digital data to be transmitted according to a data transmission protocol is divided into individual data packets in each of two transmitting/receiving stations. In each transmitting/receiving station, the number and/or length and/or priority and/or type (e.g. information, control characters, repeat blocks) of the data packets generated by the data transmission protocol of the higher level and transmitted to the respective transmitter of the station is determined (data packet identifications). According to the data packet identifications, the data transmission protocol is then selected in at least one of the stations in accordance with an optical utilization of the radio channel capacity.

(57) Zusammenfassung

Zum Optimieren der Datenübertragung über einen bidirektionalen Funkkanal, bei der in jeder der beiden Sende/Empfangs–Stationen die zu sendenden digitalen Daten nach einem Datenübertragungsprotokoll in einzelne Datenpakete aufgeteilt werden, wird in jeder Sende/Empfangs–Station die Anzahl und/oder die Länge und/oder die Priorität und/oder die Art (z.B. Information, Kontroll/Steuerungszeichen, Wiederholungsblöcke) der durch das Datenübertragungsprotokoll der höheren Eben erzeugten und zum jeweiligen Sender der Station übertragenen Datenpakete bestimmt (Datenpaketkennungen); in Abhängigkeit davon wird dann das Datenübertragungsprotokoll in mindestens einer der Stationen im Sinne einer optimalen Nutzung der Funkkanalkapazität ausgewählt.

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Anordnung zum Optimieren der Datenübertragung über einen bidirektionalen Funkkanal

Die Erfindung betrifft und geht aus von einer Anordnung laut Oberbegriff des Hauptanspruches.

Zur Übertragung von digitalen Daten, wie digitalisierte Sprache oder andere digitale Informationen über einen in beiden Übertragungsrichtungen (bidirektionalen) Kurzwellen-Funkkanal ist es bekannt, die zu übertragenden digitalen Daten, die abwechselnd in Hin- und Rückrichtung über den Funkkanal übertragen werden, nach einem vorgegebenen Datenübertragungsprotokoll, im folgenden DÜP genannt, aufzubereiten und dabei in einzelne Datenpakete aufzuteilen (z.B. nach A.S. Tanenbaum, Computer Networks, Prentice-Hall, Englewood Cliffs, 1981, Seiten 136 ff). Dabei können diese zu übertragenden digitalen Daten auch schon vorher in einer höheren Ebene nach einem anderen Datenübertragungsprotokoll, im folgenden DÜPHE genannt, aufbereitet sein, beispielsweise nach dem bekannten TCP/IP (Transmission Control Protocol/Internet Protocol)-Protokoll. Zum Optimieren der Datenübertragung über einen solchen bidirektionalen Funkkanal wurde auch schon vorgeschlagen, die Bitfehlerrate empfangsseitig zu messen und an den Sender zurückzuübertragen und dort in Abhängigkeit davon u.a. die Länge der Datenpakete entsprechend zu ändern (ältere Patentanmeldung 196 51 593.9).

Je nach Art der zu übertragenden digitalen Daten und des diese aufbereitenden Datenübertragungsprotokolls der höheren Ebene, z.B. TCP/IP (DÜPHE), können die anfallenden Datenpakete und Quittungen in beiden Übertragungsrichtungen sehr unterschiedliche Länge und Häufigkeit aufweisen und es kann damit selbst bei Anwendung der erwähnten Optimierung der Datenübertragung mit dem DÜP zu erheblichen Beeinträchtigungen des Datendurchsatzes kommen.

Es ist daher Aufgabe der Erfindung, eine Anordnung zum Optimieren der Datenübertragung über einen bidirektionalen Funkkanal zu schaffen, bei der die zur Verfügung stehende bidirektionale Kanalkapazität jeweils an die in beiden Richtungen anfallenden Datenaufkommen optimal angepaßt ist.

Diese Aufgabe wird ausgehend von einer Anordnung laut Oberbegriff des Hauptanspruches durch dessen kennzeichnende Merkmale gelöst. Vorteilhafte Weiterbildungen ergeben sich aus den Unteransprüchen.

Gemäß der Erfindung werden vor der Aussendung der Datenpakete der DÜP die Datenpaketkennungen der DÜPHE laut Hauptanspruch, also die Anzahl und/oder Länge und/oder Priorität und/oder Art der Datenpakete ermittelt und in Abhängigkeit davon die Länge der Datenpakete der DÜP eingestellt. Dabei sind die verschiedenartigsten Kombinationsmöglichkeiten für diese Datenpaketkennungen denkbar. Im einfachsten Fall kann es ausreichen, nur die momentane bzw. zu erwartende Anzahl der Datenpakete zu ermitteln. Besser wird die Anpassung, wenn zusätzlich auch noch die momentane bzw. zu erwartende Länge der Datenpakete der zu übertragenden Daten als Kennung mit berücksichtigt wird. Noch besser ist es, auch noch die momentane bzw. zu erwartende Priorität der vom DÜPHE in das DÜP einlaufenden Datenpakete zu ermitteln bzw. die momentane bzw. zu erwartende Art (Information, Quittung, Steuerbefehle od.dgl.). Eine weitere Kennung kann die jeweilige Aktualität der Datenpakete der DÜPHE sein, beispielsweise die Information darüber, daß es sich um ein Wiederholungspaket handelt. Diese quantitative Erfassung der Datenpaketkennungen erfolgt auf beiden Seiten der Funkstrecke und aus diesen Kennungen können dann die Parameter des Datenübertragungsprotokolls DÜP im Sinne einer optimalen Nutzung der Funkkanalkapazität eingestellt werden. Als besonders vorteilhaft hat es sich dabei erwiesen, die Länge der Datenpakete entsprechend zu beeinflussen und damit auch die Häufigkeit, mit der zwischen den beiden Richtungen des Funkkanals umgeschaltet wird.

Die Erfindung wird im folgenden anhand einer schematischen Zeichnung an einem Ausführungsbeispiel näher erläutert.

Die Figur zeigt das Prinzipschaltbild einer bidirektionalen Kurzwellenverbindung zwischen einer Sende/Empfangs-Station A und einer Sende/Empfangs-Station B. Die zu übertragenden digitalen Daten werden durch ein Datenübertragungsprotokoll (DÜPHE) z.B. TCP/IP in einzelne Pakete aufgeteilt, die nacheinander über einen Radiotreiber RA dem Datenübertragungsprotokoll DÜP des eigentlichen Senders der Station A zugeführt und über den Funkkanal zur Gegenstation B übertragen und im dortigen Empfänger mit dessen DÜP ausgewertet werden. Im Sendebetrieb der Gegenstation B werden in gleicher Weise die zu übertragenden digitalen Daten aufbereitet und über einen Radiotreiber RB dem DÜP des Senders der Station B zugeführt und über den Funkkanal zur Station A übertragen. Die jeweils von den DÜP erzeugten Pakete können sich beispielsweise aus einer variablen Anzahl von Rahmen zusammensetzen, die Anzahl der Rahmen pro Paket kann von der Güte der Funkverbindung abhängen und beispielsweise zwischen 1 und 15 liegen. Jeder Rahmen kann seinerseits aus einem beispielsweise 5 Byte langen Header aus Kontroll- und Steuerinformationen, einem anschließenden beispielsweise zwischen 4 und 250 Byte langem Datenanteil und einem beispielsweise 2 Byte langen Redundanzcode (CRC) bestehen. Durch Wahl der Datenmenge je Rahmen und Wahl der Anzahl der Rahmen in einem Paket kann somit senderseitig in jeder Station A und B die Paketlänge des DÜP beliebig, beispielsweise zwischen 64 Byte und 8 kByte gewählt werden.

Von den aus den DÜPHE in den Radiotreiber RA bzw. RB einlaufenden Datenpaketen wird nun die Anzahl, die Länge, die Priorität bzw. die Art (Kontroll- oder Steuerinformation, Dateninformation, Quittungen etc.) ermittelt und in Abhängigkeit von diesen Kenngrößen wird das Datenübertragungsprotokoll DÜP, mit dem die zu übertragenden Datenpakete vor ihrem Aussenden über den Sender der Station A noch einmal in einzelne Datenpakete aufgeteilt werden, entsprechend eingestellt. Wird beispielsweise in dem Radiotreiber RA eine Anzahl von zu übertragenden kurzen Datenpaketen von z.B. 100 Byte festgestellt, so wird die Länge der über das Datenübertragungsprotokoll DÜP erzeugten Datenpakete auf diese Länge eingestellt. Laufen in den Radiotreiber z.B. einige lange Pakete von beispielsweise einigen Kilobyte, so werden die Pakete DÜP so weit verlängert, wie es das Datenaufkommen der Gegenstation und die momentane Kanalqualität erlauben.

ANSPRÜCHE

1. Anordnung zum Optimieren der Datenübertragung über einen bidirektionalen Funkkanal, bei der in jeder der beiden Sende/Empfangs-Stationen die zu sendenden digitalen Daten nach einem Datenübertragungsprotokoll in einzelne Datenpakete aufgeteilt werden,
dadurch gekennzeichnet,
daß in jeder Sende/Empfangs-Station (A bzw. B)
die Anzahl
und/oder die Länge
und/oder die Priorität
und/oder die Art (z.B. Information, Kontroll/Steuerungszeichen, Wiederholungsblöcke)
der durch das Datenübertragungsprotokoll der höheren Ebene (DÜPHE) erzeugten und zum jeweiligen Sender der Station übertragenen Datenpakete bestimmt wird (Datenpaketkennungen) und in Abhängigkeit davon das Datenübertragungsprotokoll (DÜP) in mindestens einer der Stationen im Sinne einer optimalen Nutzung der Funkkanalkapazität gewählt wird.

2. Anordnung nach Anspruch 1,
dadurch gekennzeichnet,
daß in Abhängigkeit von den Datenpaketkennungen jeweils die Länge der durch das Datenübertragungsprotokoll (DÜP) erzeugten Datenpakete bestimmt wird.

3. Anordnung nach Anspruch 1 oder 2,
dadurch gekennzeichnet,
daß in der einen Station (z.B. A) die Datenpaketkennungen bestimmt werden und in Abhängigkeit davon die Datenpaketlänge in der gleichen Station (z.B. A) im Sinne einer optimalen Funkkanalkapazitätsnutzung bestimmt wird.

4. Anordnung nach Anspruch 1 oder 2,

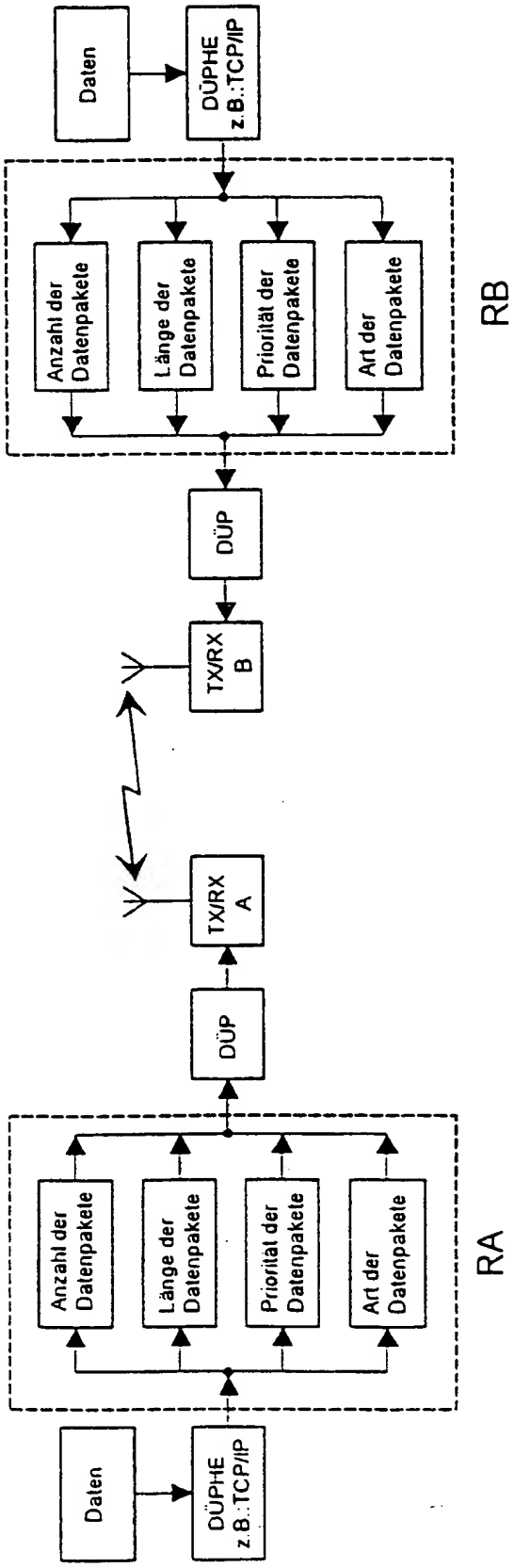
dadurch gekennzeichnet,

daß die in der einen Station (z.B. A) bestimmten Datenpaketkennungen zur Gegenstation (z.B. B) übertragen werden und dort zur Beeinflussung der Datenpaketlänge des Datenübertragungsprotokolls (DÜP) benutzt werden.

5. Anordnung nach einem der vorhergehenden Ansprüche,

dadurch gekennzeichnet,

daß die in den beiden Stationen (A und B) bestimmten Datenpaketkennungen zur jeweiligen Gegenstation übertragen werden und dort zur Einstellung der Länge der Datenpakete des Datenübertragungsprotokolls (DÜP) benutzt werden.


Daten
DÜPHE z.B.:TCP/IP
Anzahl der Datenpakete
Länge der Datenpakete
Priorität der Datenpakete
Art der Datenpakete
RB
DÜP
TX/RX B
TX/RX A
DÜP
Anzahl der Datenpakete
Länge der Datenpakete
Priorität der Datenpakete
Art der Datenpakete
RA
Daten
DÜPHE z.B.:TCP/IP

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 99/01220

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L1/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 027 348 A (CURRY JR JAMES C) 25 June 1991 (1991-06-25) abstract column 1, line 11 - line 27	1-3
A	column 2, line 24 - line 34	4,5

X	US 5 251 209 A (JURKEVICH MARK ET AL) 5 October 1993 (1993-10-05) column 3, line 59 - column 4, line 32 column 5, line 14 - line 23	1-3
A	claim 1	4,5

X	EP 0 218 448 A (CANON KK) 15 April 1987 (1987-04-15) abstract	1,2

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
7 July 1999	15/07/1999

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 730 356 A (QUALCOMM INC) 4 September 1996 (1996-09-04) abstract page 2, line 50 - line 55 claim 1 ---	1
E	EP 0 905 939 A (LUCENT TECHNOLOGIES INC) 31 March 1999 (1999-03-31) claim 1 abstract -----	1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 99/01220

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		US 5568483 A	22-10-1996
		ZA 9300290 A	22-11-1993
EP 0905939 A	31-03-1999	NONE	

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP 99/01220

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 6 H04L1/12

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IPK 6 H04L

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	US 5 027 348 A (CURRY JR JAMES C) 25. Juni 1991 (1991-06-25) Zusammenfassung Spalte 1, Zeile 11 - Zeile 27	1-3
A	Spalte 2, Zeile 24 - Zeile 34 ---	4,5
X	US 5 251 209 A (JURKEVICH MARK ET AL) 5. Oktober 1993 (1993-10-05) Spalte 3, Zeile 59 - Spalte 4, Zeile 32 Spalte 5, Zeile 14 - Zeile 23	1-3
A	Anspruch 1 ---	4,5
X	EP 0 218 448 A (CANON KK) 15. April 1987 (1987-04-15) Zusammenfassung ---	1,2

-/--

[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

[X] Siehe Anhang Patentfamilie

° Besondere Kategorien von angegebenen Veröffentlichungen :
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Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
7. Juli 1999	15/07/1999

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Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ghigliotti, L

1

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP 99/01220

C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	EP 0 730 356 A (QUALCOMM INC) 4. September 1996 (1996-09-04) Zusammenfassung Seite 2, Zeile 50 - Zeile 55 Anspruch 1 ---	1
E	EP 0 905 939 A (LUCENT TECHNOLOGIES INC) 31. März 1999 (1999-03-31) Anspruch 1 Zusammenfassung -----	1

1

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Nationales Aktenzeichen
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Deutsches Patent- und Markenamt

München, den 3. März 1999

Telefon: (0 89) 21 95 - 3206

Aktenzeichen: 198 07 931.1

Anmelder:
Rohde & Schwarz GmbH & Co. KG

Deutsches Patent- und Markenamt · 80297 München

Mitscherlich & Partner
Patent- und Rechsanwälte
Postfach 33 06 09

Ihr Zeichen: 1509-P/ay

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wirksam am 25. Februar 1998 gemäß ☒ § 43 Patentgesetz ☐ § 7 Gebrauchsmustergesetz
sind die auf den beigefügten Anlagen angegebenen öffentlichen Druckschriften ermittelt worden.
Ermittelt wurde in folgenden Patentklassen:

Klasse/Gruppe	Prüfer	Patentabt.
H04L 12/26,29/06,29/04,12/54	Leiffer	31
H04L 5/14	Krönert-Schmitt	51
H04B 7/005	Welsch	35
G08C 17/02	Skomorowski	32
H04J 3/16	Dr.Kohles	51

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Recherchiert wurde außerdem in folgenden Datenbanken:

Anlagen:
Anlagen 1, 2 und 3 zur Mitteilung der ermittelten Druckschriften

9 Druckschrift(en) bzw. Ablichtung(en)

Patentabteilung 11
Recherchen-Leitstelle

DEUTSCHES PATENT- UND MARKENAMT

198 07 931.1

Deutsches Patent- und Markenamt · 80297 München

Anlage 1

zur Mitteilung über die ermittelten Druckschriften
gemäß § 43 des Patentgesetzes

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      - eines Auftrags zur Abbuchung von dem hierfür zugelassenen Abbuchungskonto gemäß Bekanntmachung und Mitteilung Nr. 1 und 2/90 jeweils vom 15. Dezember 1989 (Bl.f.PMZ 1990, S. 1 und 2) sowie Nr. 6/92 vom 27. Februar 1992 (Bl.f.PMZ 1992, S. 177 und 178).
   b) durch Überweisung auf das umseitig angegebene Konto der Zahlstelle
   c) durch Bareinzahlung (mit Zahlschein bei der Postbank oder bei allen anderen Banken oder Sparkassen) auf das umseitig angegebene Konto der Zahlstelle.

2. Bei jeder Zahlung sind das vollständige **Aktenzeichen**, die genaue Bezeichnung des **Anmelders (Inhabers)** und die Bezeichnung der **Gebühr** (z.B. Anmeldegebühr, ...Jahresgebühr) in deutlicher Schrift anzugeben.

3. **Als Einzahlungstag gilt** gemäß § 3 der Verordnung über die Zahlung der Gebühren des Deutschen Patent- und Markenamts und des Bundespatentgerichts
   a) bei Übergabe oder Übersendung von Gebührenmarken der Tag des Eingangs;
   b) bei Übergabe oder Übersendung von Schecks oder Abbuchungsaufträgen der Tag des Eingangs beim Deutschen Patent- und Markenamt oder Bundesgericht, sofern die Einlösung bei Vorlage erfolgt (da Abbuchungsaufträge auch per Telekopie wirksam übermittelt werden können, ist es mit dieser Zahlungsart möglich, entsprechende Zahlungen noch bis 24.00 Uhr des letzten Tages der Frist vorzunehmen);
   c) bei Bareinzahlung mit Zahlschein bei der Postbank und allen anderen Banken und Sparkassen auf das Konto des Deutschen Patent- und Markenamts der Tag der Einzahlung (in diesem Falle ist vom Einzahler jedoch darauf zu achten, daß ihm der Tag (Datum) der Einzahlung von dem Geldinstitut auf dem Einzahlungsbeleg, Durchschlag etc. hinreichend deutlich bestätigt wird);
   d) im übrigen der Tag, an dem der Betrag bei der Zahlstelle des Deutschen Patent- und Markenamts eingeht oder auf dem umseitig genannten Konto gutgeschrieben wird.

Gebrauchsmusterabzweigung

Der Anmelder einer nach dem 1. Januar 1987 mit Wirkung für die Bundesrepublik Deutschland eingereichten Patentanmeldung kann eine Gebrauchsmusteranmeldung, die den gleichen Gegenstand betrifft, einreichen und gleichzeitig den Anmeldetag der früheren Patentanmeldung in Anspruch nehmen. Diese Abzweigung (§ 5 Gebrauchsmustergesetz) ist bis zum Ablauf von 2 Monaten nach dem Ende des Monats möglich, in dem die Patentanmeldung durch rechtskräftige Zurückweisung, freiwillige Rücknahme oder Rücknahmefiktion erledigt, ein Einspruchsverfahren abgeschlossen oder - im Falle der Erteilung des Patents - die Frist für die Beschwerde gegen den Erteilungsbeschluß fruchtlos verstrichen ist. Ausführliche Informationen über die Erfordernisse einer Gebrauchsmusteranmeldung, einschließlich der Abzweigung, enthält das Merkblatt für Gebrauchsmusteranmelder (G 6181), welches kostenlos beim Deutschen Patent- und Markenamt und den Patentinformationszentren erhältlich ist.

Für den Anmelder / Antragsteller

Deutsches Patent- und Markenamt

80297 München

Anlage 2

zur Mitteilung der ermittelten Druckschriften

Aktenzeichen
198 07 931.1

Erläuterungen zu den ermittelten Druckschriften:

1	2			3
Kategorie	**Ermittelte Druckschriften/Erläuterungen**			**Betrifft Anspruch**
D,X,E	DE	196 51 593 A1	gesamte Schrift	1-5
Y	DE	39 25 843 A1	insb.Fig.3.2 und 3.3 mit zugh.Beschr.	
Y	DE	36 43 834 A1	insb.Sp.3 und 4	1-5
Y	WO	97 01 900 A1	insb.S.7,1.Abs.	1
A	DE	196 13 489 A1		1
A	DE	38 14 015 A1		1
A	AIT-HELLAL,Omar, ALTMAN,Eitan: Rate Based Flow Control with Bandwidth Information. In: ETT, Vol.8, No.1, Jan./Feb. 1997, S.55-65;			
A	BRACHMAN,Barry J., CHANSON,Samuel T.: Fragmentation in Store-and-Forward Message Transfer. In: IEEE Communications Magazine, July 1988, Vol.26, No.7, S.18-27;			
A	WEINSTEIN,Clifford J., FORGIE,James W.: Experience with Speech Communication in Packet Networks. In: IEEE Journal On Selected Areas In Communications, Vol.SAC-1, No.6, Dec. 1983, S.963-980;			1

Erklärungen siehe Anlage 3 (P 2255)

DEUTSCHES PATENTAMT
80297 München

Anlage 3
zur Mitteilung der ermittelten Druckschriften

Hinweise zur Mitteilung (Vordruck P 2251)

Eine Gewähr für die Vollständigkeit der Ermittlung wird nicht geleistet (§ 43 Abs. 7 Patentgesetz bzw. § 7 Abs. 2 Gebrauchsmustergesetz i.V.m. § 43 Abs. 7 Satz 1 Patentgesetz).

Die angegebene Patentliteratur kann in den Auslegehallen des Deutschen Patentamts, 80331 München, Zweibrückenstraße 12 oder 10969 Berlin, Gitschiner Str. 97 eingesehen werden; deutsche Patentschriften, Auslegeschriften und Offenlegungsschriften auch in den Patentinformationszentren. Ein Verzeichnis über diese Patentinformationszentren kann auf Wunsch vom Deutschen Patentamt sowie von einigen Privatfirmen bezogen werden.

Erklärungen zur Anlage 2 (Vordruck P 2253)

Spalte 1: Kategorie

Es bedeutet:

- X: Druckschriften, die Neuheit oder Erfindungshöhe allein in Frage stellen
- Y: Druckschriften, die die Erfindungshöhe zusammen mit anderen Druckschriften in Frage stellen
- A: Allgemein zum Stand der Technik, technologischer Hintergrund
- O: Nicht-schriftliche Offenbarung, z.B. ein in einer nachveröffentlichten Druckschrift abgedruckter Vortrag,der vor dem Anmelde- oder Prioritätstag öffentlich gehalten wurde
- P: Im Prioritätsintervall veröffentlichte Druckschriften
- T: Nachveröffentlichte, nicht kollidierende Druckschriften, die die Theorie der angemeldetenErfindung betreffen und für ein besseres Verständnis der angemeldeten Erfindung nützlich sein können bzw. zeigen, daß der angemeldeten Erfindung zugrunde liegende Gedankengänge oder Sachverhalte falsch sein könnten
- E: Ältere Anmeldungen gemäß § 3 Abs. 2 PatG (bei Recherchen nach § 43 PatG); ältere Patentanmeldungen oder ältere Gebrauchsmuster gemäß § 15 GbmG (bei Recherchen nach § 7 GbmG)
- D: Druckschriften, die bereits in der Patentanmeldung genannt sind
- L: Aus besonderen Gründen genannte Druckschriften, z.B. zum Veröffentlichungstag einer Entgegenhaltung oder bei Zweifeln an der Priorität.

Spalte 2: Ermittelte Druckschriften / Erläuterungen

- Veröff.: Veröffentlichungstag einer Druckschrift im Prioritätsintervall
- nr: Nicht recherchiert, da allgemein bekannter Stand der Technik, oder nicht recherchierbar
- =: Druckschriften, die auf dieselbe Ursprungsanmeldung zurückgehen ("Patentfamilien") oder auf die sich Referate oder Abstracts beziehen.
- "-": Nichts ermittelt

Spalte 3: Betroffene Ansprüche

Hier sind die Ansprüche unter Zuordnung zu den in Spalte 2 genannten relevanten Stellen angegeben.